FLORIDA
HYPERTENSION IN PREGNANCY (HIP)
TOOL KIT

A QUALITY IMPROVEMENT INITIATIVE

Version 2/2016

Florida Perinatal Quality Collaborative
AT THE LAWTON AND RHEA CHILES CENTER FOR HEALTHY MOTHERS AND BABIES

Partnering to Improve Health Care Quality for Mothers and Babies

The American College of Obstetricians and Gynecologists
Women's Health Care Physicians

Florida HEALTH

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Promoting the Health of Women and Newborns

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Mission to Care. Vision to Lead.
The Florida Hypertension in Pregnancy (HIP) toolkit is intended to provide guidance to hospitals and obstetric providers in the development of individualized policies and protocols related to hypertensive disorders associated with pregnancy. It is not to be construed as a standard of care; rather it is a collection of resources that may be adapted by local institutions in order to develop standardized protocols for hypertension in pregnancy. The toolkit will be updated as additional resources become available.

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The creation of this toolkit would not have been possible without the volunteer members of our Maternal Health Committee, including the members of the Hypertension in Pregnancy Advisory Team listed on page three of this toolkit.

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Contact:
Florida Perinaul Quality Collaborative
Lawton and Rhea Chiles Center for Health Mothers and Babies
University of South Florida College of Public Health
3111 East Fletcher Avenue
Tampa, FL 33613-4660
Phone: (813) 974-9654
Fax: (813) 974-8889
E-mail: fpqc@health.usf.edu
Website: FPQC.org

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Hypertension in Pregnancy Initiative Advisory Team

Hypertension in Pregnancy Initiative Clinical Advisors

- Judette Louis, MD, MPH, FACOG, HIP Clinical Lead, Assistant Professor Dept. of OB/Gyn, USF Medicine & Dept. of Community & Family Health
- Karen Harris, MD, MPH, FACOG, Med. Dir. of Patient Safety and Quality, Florida Woman Care, LLC, ACOG District XII (Florida) Chair
- John Caravello, MD, FACOG, OB/Gyn Specialists of the Palm Beaches
- Erin Burnett, MD, FACOG, Assistant Professor of Maternal-Fetal Medicine, University of Florida Jacksonville
- Robert Egerman, MD, FACOG, Professor of Obstetrics & Gynecology, Maternal Fetal Medicine, Professor of Medicine, General Internal Medicine, University of Florida Gainesville
- Eleni Z. Tsigas, Executive Director, Preeclampsia Foundation
- Pamela Malone-Quarles, MS, RNC-OB, Director of Patient Care Services, St. Joseph’s Women’s Hospital
- Megan Gray, MD FACOG, OB/Gyn Hospitalist, Physicians Associates of Florida
- Meghan Garland, MSN, CNM, Instructor of Midwifery and Women’s Health, Frontier Nursing University, and Board President of Healthy Start of Hardee, Highlands and Polk Counties, Council of Nurse Midwives
- Sally Forsberg RNC, BSN, MBA, NEA-BC, CPHQ, Director of Quality and Patient Safety, Florida Hospital Association
- Kris-Tena Albers, CNM, MN, Florida Department of Health, Chief, Bureau of Family Health Services
- Rhonda Brown, RN, BSN, Program Administrator, Maternal and Child Health, Florida Department of Health
- Ashlee Morgan, RN, BSN, Community Health Nursing Consultant, Maternal and Child Health Section, Florida Department of Health
- Nancy Travis, MS, RN, BC, CPN, CBC, Director, Women’s Care, Cape Coral Hospital, AWHONN Florida Section
- Craig S. Kalter, MD, Maternal-Fetal Medicine, Florida Perinatal Associates - a Division of Obstetrix
- William J Schwartz III MD, Director of Maternal Fetal Medicine Sacred Heart Medical Group, Director of RPPIC, Clinical Associate Professor Department Obstetrics and Gynecology Florida State University
- Carol S. Cox MD, Assistant Professor, Division of General OB/Gyn, Department of Ob/GYN, USF College of Medicine
- Salih Y. Yasin, MD, Director of Obstetrics and Patient Safety, Women’s Hospital Center: Jackson Memorial Hospital/ Associate Professor, University of Miami Miller School of Medicine
- Jean Miles, MD, Regional Director of Obstetrical Anesthesia, Memorial Healthcare System, Sheridan Healthcorp
**FPQC Leaders and Staff**

- John Curran, MD, Professor of Pediatrics & Public Health, USF Health, FPQC Co-Director
- William Sappenfield, MD, MPH, Professor & Director of the Chiles Center, FPQC Co-Director, USF College of Public Health,
- Linda A. Detman, Ph.D., Research Associate, USF Chiles Center, FPQC Program Manager
- Annette Phelps, ARNP, MSN, USF Chiles Center, FPQC Nurse Consultant
- Emily A. Bronson, MA, MPH, LCCE, CD(DONA), USF Chiles Center, FPQC Quality Improvement Analyst
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INTRODUCTION

This document is a working draft that reflects a review of clinical, scientific and patient safety recommendations. The information presented here should not be used as a standard of care. Rather, it is a collection of resources that may be adapted by local institutions in order to develop standardized protocols for obstetric hypertension. We acknowledge the California Maternal Quality Care Collaborative (CMQCC) and the comprehensive work that they have completed in this area. With permission, we have reprinted portions of the California toolkit.

The overall goals of the Hypertension in Pregnancy Initiative Tool Kit are:

1. To decrease short- and long-term morbidity and mortality related to hypertensive disorders in women who give birth in Florida

2. To guide and support maternity care providers, outpatient care facilities, and hospitals in implementing a multidisciplinary team for pregnancy hypertension prevention and management.

This toolkit will provide obstetric care providers, staff at health care facilities and the collaborating services with the resources to locally develop their own hypertension policies and protocols with a focus on safe practices and optimizing maternal care and perinatal outcomes.

Every US birthing facility should develop and implement a policy to address hypertensive disorder events that is specific to the resources and needs of the individual institution. The policy will need to address the multidisciplinary care required for these patients because the root causes of severe maternal morbidity and mortality are often multifactorial involving standards of care, communication, collaboration, and coordination of care. Development and implementation of a standardized emergency response package (protocols) by and from the essential partners is a key component of the hypertension in pregnancy policy. The policy should also include protocols and resources to support patients’, families’, and staff’s goals of safe outcomes. Ideally, there should be a reporting mechanism with debriefing and analysis to identify systems improvement opportunities that may prevent the next case of serious morbidity/mortality. For this reason, some of the expected implementation components of the HIP initiative are related to policy and there will be measures to determine currency in this area.

Another important element is having multi-disciplinary teams in place with necessary skill sets and identified roles in preventing, responding to and timely managing hypertensive emergencies. Administration, nursing, obstetrics providers, anesthesiology, neonatology, rapid response teams, and emergency departments are all critical partners in the multidisciplinary team approach necessary to quality improvement. These teams need to train together and practice together in order to maintain and gain new competencies. Because each hospital and care team has differing resource sets, it is important to develop individualized protocols for each facility. A quality improvement team composed of a core set of team members from the involved disciplines must review current policies and data, determine the priorities for improvement, and develop a work plan to address their needs.
This tool kit is intended to improve:

1. Readiness to address hypertension in pregnancy by implementing standardized protocols,
2. Recognition of hypertension in pregnancy by improving and standardizing blood pressure measurement and assuring that education and training is in place for clinical staff regarding definitions, protocols, and standing orders.
3. Response to severe hypertension by performing regular on-site multidisciplinary drills and debriefs, assuring necessary medications are readily available, appropriate team members are participating, and
4. Reporting of hypertension in pregnancy by standardizing definitions, measures, and consistency in coding and reporting.

APPROPRIATE LEVELS OF MATERNITY CARE

It has long been the practice in Florida to have regionalized specialty care for high risk mothers and infants. Hospitals are designated as Level 1, 2, or 3 based on neonatal care specialty services. There are guidelines in the Regional Perinatal Health Care Centers Handbook for referral and transfer of high risk patients. Several studies have shown that outcomes for high risk pregnancies and infants is improved when care is provided at an appropriate level facility. More recently, ACOG has provided a consensus statement regarding levels of maternity care.

The ACOG Consensus Statement recommends four levels of care:

- **Level I Basic Care**: Routine care for low risk patients expected to have uncomplicated delivery.
- **Level II Specialty Care**: Appropriate care for low risk and higher risk patients from specially trained nursing and physician staff with an obstetrician available at all times and specialty consultants available as needed.
- **Level III Subspecialty Care**: Meets service levels of Level I and II and has availability of subspecialists onsite, by phone or telemedicine for in hospital consultation. There must be demonstrated competence to provide consistent high level care and may serve as a regional center when there are no Level IV facilities.
- **Level IV Regional Perinatal Health Care Centers**: Include all of the competencies of the Level I, II, and III centers but also have capability and experience with providing care to the most serious and complicated pregnancies throughout the antenatal, intrapartum, and postpartum periods with a distinct increase over Level III hospitals especially regarding obstetric ICU and postpartum care including a collaborative maternal-fetal medicine team approach to care.

At this time, there is no state or national designation of maternity care levels. Hospitals are encouraged to self-designate their levels in order to best provide appropriate competent care based on patient risk. With the focus on patient safety and improving outcomes, it is important that hospitals establish transfer/referral protocols and agreements into obstetric policies just as they have been done for neonatal care. It is especially important for the mother with preterm
preeclampsia with severe features to receive care at the appropriate level facility for her care needs as well as having the NICU facilities available for the preterm baby.

**HOW TO USE THIS TOOL KIT**

This tool kit is intended to provide guidance and core concepts for the quality improvement team that will include practice and administrative components. Hospitals have an obligation to patients, providers and others to assure patient safety and competent care, providers have an obligation to patients and the hospital to practice in a competent, high quality manner. These obligations are closely tied together and supportive of the multi-disciplinary team including the immediate obstetric care team and the extended team to include triage and emergency department staff, anesthesia, neonatology, rapid response teams, pharmacy, laboratory, and other support providers and services. It is everyone’s responsibility to maintain vigilance in having several components in place related to the recognition of potential for hypertension, timely management of severe hypertension, implementation of safe practices, and to report on the outcomes for future improvements. This guide offers the concepts and tools which may be adopted or adapted for local use.

This toolkit makes several references to the California Maternal Quality Care Collaborative’s Preeclampsia Toolkit. We encourage institutions to utilize this extensive resource in the development of their hypertension protocols. We recommend that you download the CMQCC toolkit as an additional resource.

The Florida HIP toolkit is designed as a working draft to be modified as new information and strategies are identified. All levels of hospitals who provide care to pregnant women can utilize the toolkit and modify the algorithms and strategies to fit their local resources and needs. The continuum of care beyond the hospital setting is important when caring for women experiencing pregnancy associated hypertension. It is important that all providers who encounter women with hypertensive disorders of pregnancy from the prenatal period through the postpartum period are ready to address the issue by understand the significance of the disorder, learn to recognize it early, respond with appropriate treatment, and have reporting mechanisms that allow tracking of outcomes and improvements in care.

References for each section are numbered in-text and listed at the end of each section.

**Disclaimer**

This toolkit is considered a resource. Readers are advised to adapt the guidelines and resources based on their local facility’s level of care and patient populations served and are also advised to not rely solely on the guidelines presented here. This toolkit is a working draft. As more recent evidence-based strategies become available, hospitals and providers should update their guidelines and protocols accordingly; the FPQC will also send out updates as well as revise these materials. Please note the version number in the footer.
References:
BACKGROUND

In 1986, the Centers for Disease Control (CDC) initiated national surveillance of pregnancy-related deaths to gather more clinical information about causes of maternal death.\(^1\) Since the late 1990s, state and national public health systems in partnerships with maternal healthcare providers and organizations such as ACOG, SMFM, AWHONN, March of Dimes, and others have renewed efforts to improve maternal health outcomes by examining the causes and circumstances of maternal death and morbidity. These partnerships have evolved over time and resulted in collaboratives that include birthing facilities and providers moving to an implementation phase. In this phase, evidence-based strategies that address the issues related to maternal morbidity and mortality are put into place in a systematic way with tools and resources intended to address a variety of factors.\(^2\)

Florida has been a part of these efforts and through the Florida Perinatal Quality Collaborative (FPQC) has formalized state level implementation of strategies to address identified issues.\(^3\) The FPQC utilizes data from the Florida Pregnancy-Associated Mortality Review (PAMR) to prioritize and focus their actions. The PAMR process has been in place since 1996 and systematically reviews pregnancy associated deaths and determines those that are pregnancy related (PRD). The multidisciplinary team also identifies issues surrounding the cases and classifies them into four quality improvement categories: clinical, healthcare system, individual/community, and death review factors.\(^4\)

From 1999-2012, the Florida PAMR Team classified 560 cases as PRDs. The leading causes of death that accounted for 64.1% of Pregnancy Related Deaths (PRDs) during the 13-year period (Figure 1), were hypertensive disorders, hemorrhage, infection, cardiomyopathy, and thrombotic pulmonary embolism.\(^5\) In the United States, hypertensive disorders of pregnancy are seen in 5% to 10% of pregnancies.\(^6\) Preeclampsia represents one in three cases of severe morbidity and is a major contributor to adverse outcomes including maternal death.\(^7\)

In October 2015, the Florida Department of Health released an updated PRD report including the period from 1999-2013. Of the 178 pregnancy-associated deaths occurring to residents of Florida from January 1, 2013, to December 31, 2013, 63 were possibly pregnancy-related. Following further review the PAMR committee found 54 (85.7%) of these deaths to actually be pregnancy-related and the leading causes of death were hemorrhage at 16.1% and hypertensive disorders at 15.9%.\(^8\)
Figure 1: Distribution of Pregnancy-Related Causes of Death Florida, 1999-2012 (n=561) and 2013 (n=54)

In the 1999-2012 report, further classification of the 560 PRDs was provided and indicated that 87 were due to hypertensive disorders and 70% of these were classified as preeclampsia or eclampsia. An additional 30% were due to other or no other specified cause of death. When all deaths due to hypertension were examined 83.9% were attributed to: Cerebrovascular hemorrhage—43.7%, other causes including encephalopathy—23%, and HELLP syndrome—17.2% (Table 1).*
Table 1: Pregnancy–Related Deaths Due to Hypertensive Disorders by Causes, Florida, 1999-2012 and 2013

<table>
<thead>
<tr>
<th>Causes of Deaths</th>
<th>1999-2012 N (%)</th>
<th>2013 N (%)</th>
<th>Change in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>85 (15.2)</td>
<td>14 (25.9)</td>
<td>70.4</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>87 (15.5)</td>
<td>11 (20.4)</td>
<td>31.6</td>
</tr>
<tr>
<td>Infection</td>
<td>71 (12.7)</td>
<td>10 (18.5)</td>
<td>45.7</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>48 (8.6)</td>
<td>4 (7.4)</td>
<td>-14.0</td>
</tr>
<tr>
<td>Thrombotic Embolism</td>
<td>57 (10.2)</td>
<td>3 (5.6)</td>
<td>-45.1</td>
</tr>
<tr>
<td>Amniotic Fluid Embolism</td>
<td>36 (6.4)</td>
<td>2 (3.7)</td>
<td>-42.2</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>62 (11.1)</td>
<td>1 (1.9)</td>
<td>-82.9</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>18 (3.2)</td>
<td>0 (0.0)</td>
<td>-</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>9 (1.6)</td>
<td>0 (0.0)</td>
<td>-</td>
</tr>
<tr>
<td>Other remaining causes*</td>
<td>65 (11.6)</td>
<td>9 (16.7)</td>
<td>44.0</td>
</tr>
<tr>
<td>Total</td>
<td>561</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

* Other remaining causes include: hematopoietic, collagen vascular diseases, metabolic, injury, cancer, pulmonary problems, neurologic/neurovascular problems, multiple organ/system failure, gastrointestinal disorders, and other conditions.

The PAMR Committee examines circumstances that surround the deaths. Through this process, they found issues and recommendations were associated with clinical quality of care and quality improvement opportunities, health care system issues, and individual and community factors.

Florida PAMR Team Hypertensive Disorders Recommendations for Actions:

Clinical Factors: Recommendations for Clinicians:

- Screen all women for previous history of preeclampsia, high blood pressure, pre-existing diabetes mellitus, obesity, and advanced maternal age to recognize a patient at risk for hypertensive disorder
- Maintain vigilance in monitoring for pulmonary edema in patients with preeclampsia and treat these patients aggressively
- Ensure that patients placed on antihypertensive medication(s) during a hospitalization demonstrate a stable blood pressure prior to discharge and have access to those medications if needed after discharge
- Providers should consider giving a pregnant woman low dose aspirin during pregnancy for prophylactic use when at risk for preeclampsia and the benefits of aspirin outweigh the risks.
- Emergency department physician and others should be educated about the warning signs of preeclampsia.
• Hospitals should have protocols on how to manage the postpartum patients with elevated blood pressure.
• Providers should consider antihypertensive medication before discharge for a woman with a history of elevated blood pressure.
• Providers need to complete follow-up on all lab orders to assist with diagnosis of preeclampsia.
• Providers need to treat hypertension within 30 minutes of patient arrival.

System Factors:
• Health care practitioners and birthing facilities should ensure policies, procedures, and standards of care are met in the care and treatment of a woman at risk of or with an existing hypertensive disorder.

Individual and Community Factors:
• All medical practitioners should review medical conditions that may have an impact on a pregnancy with all women of childbearing age
• Health care practitioners should increase patient awareness about the significance of headache and shortness of breath by including these as warning signs of preeclampsia in postpartum discharge instructions
• Pregnant women should have a prescription for a blood pressure monitor and receive specific instructions about how to use and when to contact their health care provider.

Additional information on the historical perspective of preeclampsia is available in the CMQCC Preeclampsia Toolkit, pages 12-14.

References:
FPQC Key Recommendations

Readiness
Adopt standard criteria for diagnosis, management and treatment for preeclampsia with severe features/eclampsia (include order sets and algorithms).
Goal: Within 1 hour, treat BP >/=160 systolic and/or >/=110 diastolic that persists for 15 minutes with a first line anti-hypertensive. Plan to escalate if first line therapy ineffective.

Minimum Protocol Requirements:
- Take BP using standard procedure. Recheck after 15 minutes with patient in same position. Notify provider if BP >/=160 or Diastolic BP >/=110.
- Treat severe preeclampsia with a first line antihypertensive within 1 hour of confirmation.
- Treat severe preeclampsia with magnesium sulfate for seizure prophylaxis. Consider magnesium sulfate for preeclampsia without severe features.
- Educate all women about the signs of preeclampsia.
- All women with elevated blood pressure during admission will have blood pressure rechecked within 7-10 days of birth.

Other elements for protocol inclusion:
- Notify MD if BP >140/90 with visual disturbances or central nervous system disturbances.
- Regular unit drills and team education.
- Standard process for measuring BP and assessment of severe features.
- Timely triage of pregnant and postpartum women presenting with hypertension at all inpatient and outpatient settings including ED using the standard process for measuring BP and assessment of severe features.
- Medications to treat preeclampsia with severe features/eclampsia, including administration and dosage guides, are stocked where patients are evaluated including the ED.
- Escalation plans for consultation and maternal transport to a higher level of care, as needed.

Recognition
- Adopt and implement a standard protocol for measurement of BP, evaluation for severe preeclampsia warning signs and laboratory evaluation, if indicated, for all pregnant and postpartum women.
- Implement facility-wide standards for educating all pregnant and postpartum women about warning signs of preeclampsia.
- Preeclampsia with severe features can be present without proteinuria. Do not delay treatment based on the absence of proteinuria.

Response
- Standardize protocols across L&D, postpartum, critical care and ED. Distribute checklists and algorithms for:
- Preeclampsia with severe features, eclampsia and severe hypertension
- Seizure prophylaxis with magnesium sulfate and magnesium overdose

- Antenatal corticosteroids are recommended for preeclampsia with severe features less than 34.0 weeks
- Anti-hypertensives are recommended to treat systolic BP $\geq 160$ and/or diastolic BP $\geq 110$ confirmed with a second reading 15 minutes after initial evaluation
- Magnesium sulfate for seizure prophylaxis is recommended for women with preeclampsia with severe features
- Continuation of magnesium sulfate intraoperatively during cesarean section is recommended
- Education about warning signs of preeclampsia and prompt notification of a health care provider is recommended for all pregnant and postpartum women
- Magnesium sulfate administration for seizure prophylaxis is recommended for all women with severe range BP or with visual disturbances or central nervous system symptoms
- Magnesium sulfate should be considered for women with preeclampsia without severe features
- Anti-hypertensives are suggested for postpartum women with systolic BP $\geq 150$ or diastolic BP $\geq 100$ on two occasions 4-6 hours apart.
- Maintenance of BP between 120-160 systolic and 80-105 diastolic is suggested for pregnant women with chronic hypertension
- Emotional and spiritual support should be provided to families of women admitted to intensive care with preeclampsia with severe features
- Outpatient evaluation within 7-10 days of birth for all women diagnosed with a hypertensive disorder during admission.

**REPORTING/SYSTEMS LEARNING**

- Planning huddles for high risk cases, post-event debriefs and periodic simulation training
- Evaluate all cases of severe preeclampsia, eclampsia, ICU admissions and postpartum preeclampsia for system issues
- Monitor outcome and process metrics
- Document education of all pregnant and postpartum women about the signs of preeclampsia and prompt notification of a healthcare provider.
Clinical Pearls

The following clinical pearls were compiled by the California Preeclampsia Task Force of the CMQCC in December 2013 and are reproduced here in full. All appendices referred to below are located in the CMQCC Preeclampsia Toolkit.

Important Note: The ACOG Executive Task force on Hypertension in Pregnancy released the report, "Hypertension in Pregnancy", on November 14, 2013. This report reviewed available data and reported evidence-based recommendations for prevention, diagnosis, and treatment in pregnancy. In that report it was suggested that preeclampsia be classified as preeclampsia with severe features or preeclampsia without severe features. Preeclampsia with severe features is equivalent to “severe preeclampsia,” the term that is used below.

**Acute Treatment:**

- Antihypertensive medications administered within 1 hour and ideally as soon as possible upon arrival at a healthcare facility for blood pressures of 160 systolic, and/or 105-110 diastolic or greater is a critical initial step in decreasing morbidity and mortality.

- Magnesium sulfate therapy for seizure prophylaxis should be administered to any patients with:
  - Severe preeclampsia with subjective neurological symptoms such as headache or blurry vision or right upper quadrant or epigastric abdominal pain AND
  - Should be considered in patients with preeclampsia without severe features (mild).

- Magnesium sulfate is the approved initial therapy for an eclamptic seizure.

- Algorithms for acute treatment of severe hypertension and eclampsia should be readily available or preferably posted in all labor and delivery units.

- Early post-discharge follow-up should be the norm for all patients diagnosed with preeclampsia/eclampsia. The Task Force recommends that follow-up occur within 3-7 days if blood pressure medication was used during the labor and delivery or postpartum and within 7-14 days if the diagnosis of preeclampsia was made but no medication was used. Current ACOG guidelines recommend for women in whom gestational hypertension, preeclampsia, or superimposed preeclampsia is diagnosed, that BP be monitored in the hospital or that equivalent outpatient surveillance be performed for at least 72 hours postpartum and again 7-10 days after delivery or earlier in women with symptoms.15

- Postpartum patients presenting with hypertension, preeclampsia or eclampsia to the Emergency Department should be either assessed by or admitted to an obstetrical service.
If they are treated in the Emergency Department and discharged, adequate follow-up must be arranged with an obstetrical provider.

- All institutions should consider preparing a severe preeclampsia/eclampsia box of medications and supplies needed for the treatment of preeclampsia (see Appendix, S, pg. 124 of the CMQCC toolkit) that includes at a minimum the following: Magnesium sulfate (including tubing, syringes and needles), labetalol, hydralazine and calcium gluconate. Additional medications such as second-line antihypertensives should be institution specific.

- Treatment of hypertension in the patient with chronic cocaine/amphetamine abuse may cause an exaggerated decrease in blood pressure. Hypotension may be difficult to treat due to altered vasopressor response and depleted endogenous catecholamine stores. Unexpected, severe hypotension may also occur after regional anesthesia or general anesthesia.

**PATIENT ASSESSMENT:**

- A high index of suspicion for hypertensive disorders of pregnancy and the syndrome of preeclampsia/eclampsia is required when encountering pregnant women with evidence of NEW ONSET hypertension and/or proteinuria.

- Preeclampsia is typically a disease of the late third trimester; however, earlier onset of preeclampsia prior to 34 weeks is often more severe and may have an atypical presentation. This diagnosis should be considered in any patient with new onset symptoms and signs of hypertension and/or proteinuria.

- Patients presenting with vague symptoms such as headache, abdominal pain, shortness of breath, “I just don’t feel right,” or generalized swelling should be evaluated for atypical presentations of preeclampsia or “severe features.”

- Forty percent of patients with new onset hypertension or new onset proteinuria will develop preeclampsia.

- Patients presenting with preeclampsia, severe preeclampsia or eclampsia to centers with limited resources to care for either the infant or mother should be stabilized and transferred to a center that has the capacity to care for expected complications of either the mother or infant.

**PROVIDER and PATIENT EDUCATION:**

- Healthcare professionals often tend to minimize signs and symptoms and therefore, may miss an opportunity to alter outcome.
• Use of patient education strategies, targeted to the educational level of the patients will increase patient awareness of signs and symptoms of preeclampsia.

• The importance of adequate prenatal care and access to obstetrical services should be emphasized for all socio-economic groups.

• Use of preeclampsia specific checklists, team training and communication strategies, and implementation of a continuous process improvement strategy may reduce the morbidity associated with hypertensive disorders of pregnancy.

• The patient should be counseled that hypertensive disorders during pregnancy may predict future cardiovascular risk.

• There is no clinically validated screening strategy to predict the development of preeclampsia at this time.

References


CLASSIFICATION AND DIAGNOSIS OF HYPERTENSIVE DISORDERS IN PREGNANCY

CHRONIC HYPERTENSION (PRIMARY AND SECONDARY) IN PREGNANCY

Chronic hypertension increases maternal and fetal morbidity and mortality. In examining maternal deaths in Florida between 1999 and 2012, 15% of all deaths were attributable to hypertensive disease. As many pregnant women with cardiomyopathy and cerebrovascular accidents have hypertension as a comorbidity, if we include the percentages of maternal deaths from those causes, 10% and 3%, respectively, additional deaths may be indirectly related to hypertensive diseases.

The prevalence of hypertension is increasing amongst women of childbearing age. As this population is becoming heavier and aging, they have experienced an increase in diabetes. Approximately 5% of women are diagnosed with chronic hypertension during pregnancy.\(^1\) Perinatal risks include greater frequencies of cesarean section, preterm birth (<37 weeks), superimposed preeclampsia, low birth weight, neonatal intensive care unit admissions and perinatal death.\(^2\)

Diagnosis

Diagnosis is made preferably before 20 weeks gestation and ideally before 12 weeks gestation to avoid the confounding, physiologic decrease in blood pressure noted during the second trimester. Blood pressure should be recorded in the seated position with the legs uncrossed after a few minutes of rest. An appropriately sized cuff includes the bladder width covering 40% of the arm and the bladder length encircling 80% of the arm. The cuff should be positioned 2 - 3 cm above the antecubital fossa.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Diastolic (mm Hg)</th>
<th>Systolic (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>90 – 99</td>
<td>140 – 149</td>
</tr>
<tr>
<td>Moderate</td>
<td>100 - 109</td>
<td>150 - 159</td>
</tr>
<tr>
<td>Severe</td>
<td>≥ 110</td>
<td>≥ 160</td>
</tr>
</tbody>
</table>

(Another categorization system combines mild/moderate hypertension.)

Classification of Hypertension Disorders Complicating Pregnancy\(^1\)

| Chronic (Preexisting) Hypertension                          | Systolic blood pressure greater than or equal to 140 mm Hg or diastolic blood pressure greater than or equal to 90 mm Hg that **predated** the pregnancy
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Abnormal blood pressure predating pregnancy or before 20 weeks gestation | • Systolic blood pressure greater than or equal to 140 mm Hg or diastolic blood pressure greater than or equal to 90 mm Hg that **predated** the pregnancy
|                                                             | • Systolic blood pressure greater than or equal to 140 mm Hg or diastolic blood pressure greater than or equal to 90 mm Hg that develops before 20 weeks gestation **and** first trimester blood pressures are not known

Gestational Hypertension

| Abnormal blood pressure first developing in pregnancy     | Systolic blood pressure greater than or equal to 140 mm Hg or diastolic blood pressure greater than or equal to 90 mm Hg that develops **after** 20 weeks gestation in a woman with previously normal blood pressure
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                                                           | • At least two measurements taken 4 or more hours apart
If blood pressure elevation occurs before 20 weeks gestation and first trimester blood pressure measurements are normal, then consider early onset gestational hypertension  
- Rule out preeclampsia

<table>
<thead>
<tr>
<th>Preeclampsia</th>
<th>Abnormal blood pressure as described in gestational hypertension plus proteinuria</th>
</tr>
</thead>
</table>
| • Greater than 300 mg total protein in a 24 hour collection  
• Random urine protein (mg/dL) to creatinine (mg/dL) ratio of 0.3  
• 1+ protein on urine dipstick if above quantifiable measures not available |

| Severe features for gestational hypertension and preeclampsia* | • Systolic blood pressure greater than 160 mm Hg or diastolic blood pressure greater than 110 mm Hg *(check blood pressure within 15 minutes to confirm since persistent elevation greater than 160 mm Hg or 110 mm Hg is a hypertensive emergency)*  
• CNS symptoms (generalized tonic clonic seizure, headache or visual disturbances)  
• Pulmonary edema  
• Platelet count less than 100,000/microliter  
• Elevation serum transaminases more than 2 times over baseline or ALT greater than 70  
• Serum creatinine level greater than 1.1 mg/dL or doubling of serum creatinine  
• HELLP syndrome |

<table>
<thead>
<tr>
<th>Superimposed preeclampsia</th>
<th>Chronic hypertension with the development of preeclampsia</th>
</tr>
</thead>
</table>
| • Sudden increase in blood pressure that was previously controlled requiring escalation of blood pressure medication  
• New onset proteinuria or sudden increase in proteinuria  
• Development of any of the criteria listed under “severe features” |

<table>
<thead>
<tr>
<th>Postpartum Hypertension</th>
<th>New onset condition OR Secondary to persistent hypertension</th>
</tr>
</thead>
</table>
| • BP increases again 3-6 days postpartum  
• Symptoms of preeclampsia or eclampsia, including stroke  
• Can develop up to 4-6 weeks postpartum |

*The ACOG Executive Task force on Hypertension in Pregnancy ©2013 no longer includes fetal criteria such as but not limited to intrauterine growth restriction, absent or reversal of end diastolic flow, and oligohydramnios as criteria needed to define severe gestational hypertension or preeclampsia
Secondary Causes of Hypertension

Although the majority of hypertension in child bearing aged women is primary hypertension, that is, hypertension without an underlying correctable disorder producing the hypertension, consideration should be given for correctable secondary causes.\textsuperscript{1,3} A brief listing of secondary causes is included as well as particular findings that increase the likelihood of having such a disorder. Should a secondary cause for the hypertension be suspected, the patient can be referred to a physician with expertise in the evaluation and treatment of these conditions.

### Causes of Secondary Hypertension\textsuperscript{8}

<table>
<thead>
<tr>
<th>Essential Hypertension (idiopathic)</th>
<th>Treatment consideration</th>
<th>Diagnostic tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathophysiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased renin sympathetic nerve activation in the afferent arteriole triggers an increase in sodium retention and water reabsorption. The net effect is an increase in cardiac output and systemic vascular resistance</td>
<td>• Pharmacologic modulation of cardiac output and systemic vascular resistance</td>
<td>Normal BUN and creatinine and urinalysis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Hypertension (underlying cause)</th>
<th>Treatment consideration</th>
<th>Clinical pearls and diagnostic tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathophysiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary hyperaldosteronism</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Increased secretion of aldosterone by adrenal adenoma or adrenal hyperplasia triggers sodium and water retention. Elevated aldosterone levels trigger loss of hydronium ions and potassium resulting in a metabolic alkalosis and hypokalemia | • Block aldosterone receptors on the distal tubule  
• Replace potassium | • Elevated aldosterone  
• Decreased renin  
• Decreased potassium  
• Metabolic alkalosis |
| Chronic renal disease                     |                         |                                      |
| Injury to the nephron from long standing nephritis or diabetes mellitus prevents normal sodium and water excretion | • Pharmacologic modulation of cardiac output and systemic vascular resistance | Elevated BUN and creatinine levels |
| Renal artery stenosis                    |                         |                                      |
| Stenosis or narrowing of the afferent arteriole decreases blood flow to the glomerulus triggering the release of renin. Resultant increase in angiotensin triggers vasoconstriction. Elevation of serum aldosterone level may produce loss in potassium | • Restoration of normal blood flow in renal artery through stent placement, angioplasty, or bypass surgery  
• Replace potassium  
• Pharmacologic modulation of increased systemic vascular resistance | • Presence of abdominal bruit  
• Renal vein renin levels  
• MRI of renal artery showing stenosis  
• Hypokalemia |
### Pheochromocytoma
Tumors in the adrenal medulla produce excess catecholamine leading to very high levels of circulating epinephrine and norepinephrine. This produces simultaneous cardiac stimulation and intense vasoconstriction.

- Surgical removal of adrenal tumor
- Cardiac monitoring for arrhythmia
- α-blocker and β-blocker

### Thyroid disease
**Hyperthyroid:** Elevated thyroxine level activate renin-angiotensin-aldosterone system and increase heart rate and contractility

**Hypothyroid:** Lowered thyroxine decreases nitric oxide producing less arterial compliance & vasoconstriction.

- Pharmacologic correction of underlying thyroid disorder
- β-blocker to control arrhythmia

### Coarctation of the aorta
Congenital narrowing of the descending aorta produces decreased blood pressures distal to the subclavian artery. Hypoperfusion of the afferent renal arteriole triggers increased renin activity increasing intravascular volume exacerbating upper body hypertension.

- Surgical correction
- Modulation of cardiac output
- Vascular remodeling following surgical correction may lead to persistent hypertension

### Cushing’s disease or syndrome
Pituitary adenoma secreting excess adrenocorticotropic hormone (disease) or overproduction of cortisol in the adrenal gland (syndrome).

- Blood pressure control can be challenging due to cortisol induced increase in both cardiac output and systemic vascular resistance

### Sleep apnea
Prolonged periods of apnea, hypoxia, and hypercapnia produce repeated sympathetic stimulation often leading to an increase sympathetic nerve activity.

- Continuous positive airway pressure

### Coarctation of the aorta

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Therapeutic Interventions</th>
</tr>
</thead>
</table>
| Pheochromocytoma                                                                | - Surgical removal of adrenal tumor  
- Cardiac monitoring for arrhythmia  
- α-blocker and β-blocker                                                         |
| Thyroid disease                                                                 | - Pharmacologic correction of underlying thyroid disorder  
- β-blocker to control arrhythmia                                                  |
| Coarctation of the aorta                                                        | - Surgical correction  
- Modulation of cardiac output  
- Vascular remodeling following surgical correction may lead to persistent hypertension |
| Cushing’s disease or syndrome                                                     | - Blood pressure control can be challenging due to cortisol induced increase in both cardiac output and systemic vascular resistance |
| Sleep apnea                                                                     | - Continuous positive airway pressure                                                   |

**Possible Clinical Signs:**
- Tachycardia, sweating, headache
- MRI of adrenal gland
- Elevation of serum or urine vanillylmandelic acid (VMA) and metanephrine
- Goiter, exophthalmos
- Serum thyroid stimulating hormone, thyroxine, and tri-iodothyronine levels
- Elevated blood pressure in head and neck and arms compared to lower extremities
- Echocardiogram, magnetic resonance and computerized tomogram angiography
- Abdominal striae, buffalo hump, central obesity, moon facies
- Elevated 24 hour urine cortisol
- Glucose intolerance
- Daytime fatigue, obesity, and excessive snoring
- Sleep study
Initial Assessment
Not all patients need to undergo a detailed assessment of secondary causes, but all patients should have at least a minimal evaluation including:

Physical examination:
- Blood pressure measurements in both arms
- Pulse
- Examination of the eyes for exophthalmos
- Examination of the neck for a goiter
- Auscultation of the heart for murmurs or gallops
- Auscultation of the lungs for crackles
- Auscultation of the epigastrum and flanks for bruits
- Assessment for pedal edema
- Assessment for concordant pulses in the radial and dorsalis pedal arteries
- Examination of the skin for striae, central obesity, and buffalo hump

Laboratory assessment:
- CMP
- TSH
- Urinalysis
- Urine protein creatinine ratio
- (Other studies as clinically indicated such as 12 lead electrocardiogram and echocardiography in those with poorly controlled blood pressure or those at risk for cardiomyopathy)

Treatment of Chronic Hypertension
Somewhat controversial is if and when to initiate antihypertensive therapy. Patients with diastolic blood pressure > 105 mm Hg or systolic blood pressure ≥ 160 mm Hg benefit from antihypertensive treatment. Although there is a reduction in progression to severe hypertension by treating those with mild to moderate hypertension, there may be a risk for this treatment contributing to small for gestational age fetal growth. Interestingly, although the reduction in frequency of developing severe hypertension is recognized, the risk for progression to preeclampsia is not altered by treatment.[4] Women with end organ damage (cardiac, renal, cerebrovascular, eye and other) will likely benefit from initiation of therapy of lower pressures than those stated above.

Importantly, the greatest risk for cerebrovascular accident during pregnancy is when systolic blood pressure exceeds 155-160 mm Hg. Avoiding this degree of hypertension, particularly in the peripartum period, is warranted.

Choice of Antihypertensive Agent
If an antihypertensive is selected, labetalol, methyldopa and long acting nifedipine are the preferred agents. Families of drugs such as ACEi (angiotensin converting enzyme inhibitors), ARBs (angiotensin receptor blockers), renin inhibitors and mineralocorticoid receptor antagonists should be discontinued due to their teratogenic potential.
Options for initiation of therapy and dosing are listed in the tables provided at the end of this section. Other options may be reasonable, as for example in the setting of left ventricular dysfunction, marked proteinuria or volume overload, but most patients can be managed by using labetalol, nifedipine, and methyldopa.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Initial dosing</th>
<th>Frequency</th>
<th>Total maximal daily dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labetalol*</td>
<td>200 mg bid</td>
<td>Q 12 hours to Q 8 hours</td>
<td>2400 mg</td>
</tr>
<tr>
<td>Nifedipine long acting</td>
<td>30 mg daily</td>
<td>Daily</td>
<td>120 mg</td>
</tr>
<tr>
<td>Methyldopa**</td>
<td>250 mg bid</td>
<td>Q 12 hours to Q 6 hours</td>
<td>3000 mg</td>
</tr>
</tbody>
</table>

* Nonselective B and α blocker, avoid with asthma, heart block, heart failure; switch to calcium blocker if uterine irritability occurs
** May be less effective than others, may be associated with hemolysis or hepatic injury, lethargy

Goals for blood pressure control include:
Ideally control of blood pressure is a reasonable balance between the maternal risk of stroke and end organ damage and the uteroplacental needs of the fetus. No definitive rules are set, but the ranges below serve as a guideline. The authors view 140-149/80-90 as an acceptable compromise.

- Systolic blood pressure 120 – 160 mm Hg
  - (≤ 155 mm Hg may allow a wider margin of maternal safety)
- Diastolic blood pressure 80 - 105 mm Hg
  - (≤ 100 mm Hg may allow a wider margin of maternal safety)

The frequency of blood pressure (office/provider) measurements should be at least every two weeks. For those whose blood pressure is not optimally controlled, more frequent assessment is warranted including home blood pressure recordings and tools for reporting these values to the practitioner’s office with clear instructions for when the patient should present to her provider’s office or Emergency Department (danger instructions).

**Fetal Assessment**
Because of the higher risk for fetal growth impairment, sonography to assess fetal growth is recommended. The frequency and timing of this assessment is variable. Mid and late third trimester screening may be helpful and more frequent assessment is probably necessary in those patients requiring multiple medications, having evidence of end organ damage or other comorbidities, or a history of adverse perinatal outcome (including preeclampsia or poor fetal growth). Antenatal fetal testing utilizing a composite biophysical profile score (including non-stress test) for assessment of the fetal heart rate pattern as well as fetal movements, tone, breathing and amniotic fluid volume. The timing and frequency of this testing is variable, although many advocate beginning this at 34 weeks gestation with semiweekly testing. In low resource settings without ready access to ultrasound, a fetal non-stress test is an alternative.
Timing of Delivery
Given adequate maternal blood pressure control and reassuring fetal testing as well as no features of preeclampsia, delivery should not be scheduled before 38 weeks gestation. If fetal growth is impaired, umbilical artery velocimetry can be useful in determining the timing of delivery. If frequent medication adjustments are needed, or growth is impaired, delivery can be considered earlier such as 36 – 37 weeks gestation. Should the pregnancy become complicated by superimposed preeclampsia, delivery is performed as described below.

Development of Superimposed Preeclampsia
A sizeable portion (13-40%) of women with chronic hypertension will develop superimposed preeclampsia with the attendant risks for poor pregnancy outcomes (accelerated hypertension, target organ damage, cesarean section, fetal growth restriction and perinatal mortality). Worsening hypertension, new onset proteinuria, maternal signs or symptoms of preeclampsia are indications that the pregnancy is complicated by superimposed preeclampsia. The patient should be hospitalized for evaluation and management. As with the patient without chronic hypertension who develops preeclampsia, antenatal glucocorticoids are administered if the gestational age is <34 weeks.

With no signs or symptoms of preeclampsia with severe features, the pregnancy can be continued until 37 weeks gestation. The decision to manage a patient with superimposed preeclampsia without severe features as an outpatient requires proven maternal and fetal stability during the hospitalization as well as consultation with maternal fetal medicine. The impetus for prolonged hospitalization relates to the inability to emergently address the hazards of expectant management of preeclampsia such as abruption, fetal distress or a rapidly deteriorating maternal status while the patient is at home. When outpatient care is chosen it is imperative that serial assessments of maternal and fetal well-being are ascertained, and a low threshold for re-hospitalization is communicated to the patient.

Should severe features of preeclampsia develop, delivery is performed at 34 weeks as long as the maternal and fetal status remains stable until that time.

The pregnancy can continue with severe features until 34 weeks gestation as long as:
- No maternal symptoms of severe disease (persistent headache, CMS changes, visual disturbances, and GI symptoms)
- Maternal blood pressure is controlled
- No eclampsia
- No pulmonary edema
- No evidence of placental abruption
- No disseminated intravascular coagulation
- No evidence of fetal compromise
- No laboratory abnormalities with significant thrombocytopenia, hemolysis, liver or renal compromise as previously mentioned

Expectant management of preeclampsia with severe features before 34 weeks gestation is best addressed in a tertiary care center.
Management of Superimposed Preeclampsia
Timing of delivery was outlined above depending on the degree of maternal and fetal stability as well as the development (or lack thereof) of severe features. Magnesium sulfate is recommended for the prevention of seizures. Intrapartum fluid administration should be carefully monitored, and as a general rule, to not exceed 80 to 100 mL per hour. Liberal fluid administration will increase the risk for third spacing of fluid and pulmonary edema. Urine output, respiratory status and oxygenation levels are monitored during the process. Team members (obstetrics, anesthesia and nursing) should be aware of appropriate fluid administration in this setting. Intrapartum, standard laboratory evaluation as well as thromboembolic prophylaxis with mechanical compression devices are routinely part of the management. Emergent therapy of acute onset severe hypertension during pregnancy and postpartum is summarized in the section on acute treatment and management.

Postpartum Assessment
Blood pressure postpartum can typically be controlled with the antihypertensive used by the patient antenatally. For excessive fluid retention as manifested by significant pedal edema, pulmonary crackles or jugular venous distention (possible fluid overload), a few doses of a diuretic may be helpful. The provider needs to be careful not to create or worsen existing electrolyte abnormalities or renal compromise. The use of nonsteroidal anti-inflammatory agents should be used with extreme caution if at all.

After discharge the patient is advised to have her blood pressure checked within 48 to 72 hours and to notify her provider if the values are > 150 mm Hg systolic or > 100 mm diastolic.¹ Reassessment by providers should be performed 7 – 10 days after delivery as well. Furthermore, she should be seen at an emergency room or labor & delivery unit (depending on service setting) if she experiences concerning danger signs, for example: headache, visual changes, dyspnea, shortness of breath or abdominal pain. At this point the patient would be readmitted to the hospital, placed on magnesium sulfate, administered appropriate antihypertensive therapy and provided prophylaxis for thromboembolic disease. Persistently elevated blood pressure of ≥ 160 mm Hg systolic or ≥ 110 mmHg diastolic should be treated within 1 hour of presentation. Otherwise the threshold for beginning therapy postpartum is systolic > 150 mm Hg or diastolic > 100 mm Hg.¹,⁶

Prevention of Preeclampsia
Low dose oral daily aspirin (81 mg or less) beginning at 12 weeks gestation has shown to reduce the risk of developing preeclampsia by 24% (as well as a reduction in preterm birth by 14% and growth restriction by 20%). This low dose aspirin prophylaxis can be considered for patients at risk for preeclampsia including those with a prior history of preeclampsia, pre-gestational diabetes, multifetal gestation, autoimmune disease, renal disease, or chronic hypertension.⁷

References


### Medications Used to Treat Hypertension in Pregnancy

<table>
<thead>
<tr>
<th>Name, dose</th>
<th>Class</th>
<th>Pharmacology</th>
<th>1/2 life (h)</th>
<th>Preferred when</th>
<th>Dose considerations</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labetalol (IV)*</td>
<td>C</td>
<td>Selective α1-adrenergic (SR isomer) and nonselective β-adrenergic blocker (RR isomer)</td>
<td>1.7 hours to 6 to 8 hours</td>
<td>Maternal tachycardia is present</td>
<td>Clearance both isomers similar with IV dosing</td>
<td>Asthma because of nonselective β-adrenergic blockade</td>
</tr>
<tr>
<td>2 minutes</td>
<td></td>
<td></td>
<td></td>
<td>When cardiac output is primary driver for hypertension</td>
<td>RR clearance much faster than SR clearance following oral administration</td>
<td>Decompensated heart failure, AV heart block, bradycardia</td>
</tr>
<tr>
<td>First: 20 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower doses favor modulation of blood pressure (α1 block)</td>
<td>Caution with pheochromocytoma</td>
</tr>
<tr>
<td>Second: 40 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Higher doses slow heart rate (β block)</td>
<td></td>
</tr>
<tr>
<td>Third: 80 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Because of shorter half-life consider three times daily dosing if heart rate control is important</td>
<td></td>
</tr>
<tr>
<td>Max: 220 mg</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Labetalol PO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start at 100 mg and titrate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max: 2,400 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydralazine IV*</td>
<td>C</td>
<td>Selective vasodilation by through alteration of calcium metabolism within vascular smooth muscle</td>
<td>2 to 6 hours</td>
<td>When maternal bradycardia is present</td>
<td>Selective vasodilation will produce hypotension and compensatory increase in cardiac output</td>
<td>Cerebral edema</td>
</tr>
<tr>
<td>2 minutes</td>
<td></td>
<td></td>
<td></td>
<td>When vascular resistance is primary driver for hypertension</td>
<td>Requires decreased dosing with altered renal function</td>
<td>Recent stroke</td>
</tr>
<tr>
<td>First: 5-10 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cerebral vasodilation may exacerbate cerebral edema</td>
<td>Severe mitral valve disease</td>
</tr>
<tr>
<td>Second: 10 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max: 25 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydralazine PO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start 50 mg and titrate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max: 300 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*used to treat hypertensive emergencies

**Side effects**

- Neonatal bradycardia

**Contraindications**

- Asthma because of nonselective β-adrenergic blockade
- Decompensated heart failure, AV heart block, bradycardia
- Caution with pheochromocytoma

**Side effects**

- Hypotension and oliguria
- Maternal flushing
- Lupus like syndrome
- Nausea, vomiting
<table>
<thead>
<tr>
<th>Name, dose</th>
<th>Class</th>
<th>Pharmacology</th>
<th>1/2 life (h)</th>
<th>Preferred when</th>
<th>Dose considerations</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nifedipine*&lt;br&gt; First: 10 mg&lt;br&gt; Second: 10-20 mg&lt;br&gt; Third: 20 mg&lt;br&gt; Max: 50 mg&lt;sup&gt;2,3&lt;/sup&gt;</td>
<td>C&lt;br&gt;C</td>
<td>• Dihydropyridine class that preferentially binds to L-type calcium channels in vascular smooth muscle leading to relaxation&lt;br&gt; • Poor affinity to L-type calcium channels in myocytes often results in reflex tachycardia&lt;br&gt; • Modulates vascular resistance&lt;br&gt; • Gradual onset&lt;br&gt; • Metabolized by liver increased in pregnancy</td>
<td>2 – 7 hours (immediate vs. intermediate, respectively)&lt;br&gt;Onset, peak (min)&lt;br&gt;15 – 30 minutes, 60 minutes</td>
<td>• Maternal bradycardia or oliguria is present&lt;br&gt; • IV access not available</td>
<td>• Oral administration only&lt;sup&gt;2,3&lt;/sup&gt;&lt;br&gt; • During hypertensive emergency, equally efficacious to IV labetalol and IV hydralazine&lt;sup&gt;1,6&lt;/sup&gt;&lt;br&gt; • Theoretical synergism with magnesium sulfate causing hypotension&lt;br&gt; • Because it is a pure vasodilator, expect compensatory increase in cardiac output&lt;sup&gt;4&lt;/sup&gt;&lt;br&gt; • Dilates renal artery and may improve natriuresis&lt;sup&gt;4&lt;/sup&gt;&lt;br&gt; • Increased clearance may require more frequent dosing&lt;sup&gt;5&lt;/sup&gt;</td>
<td>• Aortic stenosis&lt;br&gt; • Hypotension&lt;br&gt; • Recent MI or coronary artery disease, cardiogenic shock</td>
</tr>
<tr>
<td>Nicardipine*&lt;br&gt; Initial: 2.5 to 5 mg per hour and titrate to effect q 15 minutes&lt;br&gt; Max: 15 mg per hour</td>
<td>C</td>
<td>• Second generation dihydropyridine&lt;br&gt; • Rapid onset&lt;br&gt; • Modulates vascular resistance&lt;br&gt; • Dilatory effects on coronary arteries improves cardiac ischemia</td>
<td>4 to 6 hours&lt;br&gt;Onset, peak (min)&lt;br&gt;5 – 15 minutes, none</td>
<td>• Cardiac ischemia present</td>
<td>• Oral and IV administration&lt;br&gt; • Compensatory tachycardia&lt;br&gt; • Use caution with other magnesium sulfate</td>
<td>• Aortic stenosis&lt;br&gt; • Cardiogenic shock</td>
</tr>
</tbody>
</table>

Side effects

- Tachycardia
- Hypotension
- Flushing, nausea, lightheadedness

Contraindications

- Aortic stenosis
- Hypotension
- Recent MI or coronary artery disease, cardiogenic shock

- Tachycardia
- Hypotension
- Flushing, nausea, lightheadedness
<table>
<thead>
<tr>
<th>Name, dose</th>
<th>Class&lt;sup&gt;10&lt;/sup&gt;</th>
<th>Pharmacology&lt;sup&gt;3,12&lt;/sup&gt;</th>
<th>1/2 life (h)</th>
<th>Preferred when</th>
<th>Dose considerations</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clonidine</td>
<td>C</td>
<td></td>
<td>6 to 20 hour</td>
<td>No pregnancy specific data about onset of action</td>
<td>• More favorable side effect profile compared to α-methyldopa&lt;sup&gt;5&lt;/sup&gt;</td>
<td>• Caution with hypertension and cardiac disease</td>
</tr>
<tr>
<td>0.1 mg (oral) for emergency hypertension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Due to increased oral clearance, three times daily dosing preferred&lt;sup&gt;5&lt;/sup&gt;</td>
<td>• May cause severe hypotension, bradycardia, AV heart block, and</td>
</tr>
<tr>
<td>0.2 to 0.6 mg (oral) twice daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Decrease dose with renal impairment&lt;sup&gt;12&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Max: 2.4 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Rebound hypertension with abrupt withdrawal</td>
<td></td>
</tr>
<tr>
<td>α-methyldopa</td>
<td>B</td>
<td></td>
<td>1.75 hours</td>
<td>No pregnancy specific data about onset of action</td>
<td>• May be given three times daily</td>
<td>Contraindications</td>
</tr>
<tr>
<td>Initial: 250 to 500 mg twice daily (oral)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Requires monitoring of liver function</td>
<td>Liver disease</td>
</tr>
<tr>
<td>Max: 3 g daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Decrease dose with renal impairment&lt;sup&gt;12&lt;/sup&gt;</td>
<td>Side effects</td>
</tr>
<tr>
<td>Furosemide</td>
<td>C</td>
<td></td>
<td>0.5 to 1 hour</td>
<td>Pulmonary edema</td>
<td>• Considered a second line agent to treat hypertension</td>
<td>• Myocarditis</td>
</tr>
<tr>
<td>Initial (IV): 20 to 40 mg IV Second: 20 mg in 2 hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Reduction of capillary hydrostatic pressure allows for improvement in edema&lt;sup&gt;12&lt;/sup&gt;</td>
<td>• Hemolytic anemia</td>
</tr>
<tr>
<td>Initial (oral): 10 to 40 mg twice daily Max: 600 mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hepatic necrosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Bradycardia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Side effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hypokalemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hypomagnesemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hypovolemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Metabolic alkalosis</td>
</tr>
</tbody>
</table>

(See references 3 and 12 for citations discussing clinical pharmacology)
(See reference 11 for non-emergent medication dosing, non-pregnancy specific serum half-life and onset of action parameters, and contraindication and side effect profiles)
## Observed/Reported adverse fetal and neonatal effects with anti-hypertensive medications

<table>
<thead>
<tr>
<th>Name or medication class</th>
<th>Contraindicated</th>
<th>Observed fetal and neonatal effects</th>
</tr>
</thead>
</table>
| Angiotensin converting enzyme inhibitors\(^7,^8\) | Yes | • Any pregnancy exposure increases risk for cardiovascular, central nervous system, and calvarium malformations, acute renal failure, and pulmonary hypoplasia  
• Long term neonatal effects include impaired renal function, hypertension and proteinuria, and polycythemia |
| Angiotensin receptor blocker\(^7,^8\) | Yes | • Any pregnancy exposure increases risk for intrauterine fetal death or miscarriage, pulmonary hypoplasia and respiratory distress syndrome, oliguria and anuria and oligohydramnios, calvarium malformations, limb defects, persistent ductus arteriosus  
• Long term neonatal effects include impaired renal function |
| α-methyldopa\(^9\) | No | • No known adverse effect on uteroplacental perfusion  
• Neurocognitive safety data proven to 7 years after birth |
| β-blockers\(^5\) | No | • Greater risk for Small for gestational age neonates (SGA) |
| Calcium channel blockers\(^10\) | No | • Less safety data compared to other drug classification  
• No known adverse effects |
| Diuretics\(^10\) | No | • Neonatal thrombocytopenia with thiazide diuretics  
• No known adverse effects using furosemide |
| Clonidine\(^10\) | No | • Limited first trimester data  
• No observed adverse fetal effects |

### References
2. ACOG District II Safe Mother Initiative. Maternal Safety Bundle for Severe Hypertension in Pregnancy
7. Bullo M, Tschumi S, Bucher BS, Bianchetti MG, Simonetti GD. Pregnancy Outcome Following Exposure to Angiotensin-Converting Enzyme Inhibitors or Angiotensin Receptor Agonists: A Systematic Review. *Hypertension* 2012;60:444-50
12. Kablunde, R. *Normal and Abnormal Blood Pressure (Physiology, Pathophysiology, and Treatment)*. Copyright © 2013. Epublication on Kindle
This algorithm is reproduced from the CMOCC Preeclampsia Toolkit. The FPQC advisory committee recommends using a BP trigger of $\geq 140/90$. 
**POSTERIOR REVERSIBLE ENCEPHALOPATHY SYNDROME (PRES)**

**Background**
Posterior reversible encephalopathy syndrome (PRES) is a temporary entity characterized by clinical signs and symptoms. These most often include but are not limited to hypertension, generalized seizure activity, altered mental status, headache and vision changes. In addition, specific findings are appreciated on head computed tomography (CT) or magnetic resonance imaging (MRI) scan.¹ Many causes of PRES have been reported in the literature including hypertensive encephalopathy, preeclampsia, eclampsia, renal failure, immunosuppressants, thrombotic thrombocytopenic purpura, systemic lupus erythematosus (SLE), and acute intermittent porphyria.² Preeclampsia and eclampsia are thought to be the most common causes of PRES. Routine imaging on preeclamptic and eclamptic patients is not done, therefore the true incidence of PRES is unknown.

**Symptoms**
Headaches and vision changes constitute neurological symptoms in severe preeclampsia. These symptoms result from cerebral edema and vasospasms of the retinal and cerebral vessels. In addition, nausea, vomiting and right upper quadrant pain reflect hepatocellular involvement.³ Some or all of these symptoms often precede eclampsia.

**Radiology findings**
Findings as noted below appear as intense signals on T2 weighted MRI scans, most often noted in the occipital and posterior parietal lobes. The pathophysiology of these findings is related to endothelial dysfunction in addition to the failure of cerebral auto-regulation. This leads to a disruption of the blood brain barrier and hence leaking of fluid and protein.⁴

Axial fluid-attenuated inversion recovery (FLAIR) image through the level of the temporal and occipital lobes demonstrates bilateral asymmetric areas of increased signal intensity involving the gray and subcortical white matter of the posterior temporal and occipital lobes.⁵
Treatment
Prompt treatment of blood pressures along with seizure prophylaxis decreases long term sequelae. In rare cases the edema can progress to ischemia, cerebral infarction and death.

Recommendations for Quality Improvement:
1. The treatment of PRES calls for a decrease in blood pressure within the first 2-6 hours.
2. First-line antihypertensive medications are easily titratable intravenous Labetalol or Hydralazine, or Nifedipine by mouth.
3. Magnesium sulfate is the treatment of choice for controlling the seizures associated with PRES and it should be continued for at least 24 hours after the last seizure.
4. In these complex clinical cases, a multidisciplinary team of ED, OB, Anesthesia, and possibly Neurology or Critical Care is necessary.
5. Do not delay treatment of blood pressure or initiation of magnesium to perform neuroradiologic imaging.
6. Neuroradiologic imaging is strongly advised in the postpartum period in the face of seizures or neurological symptoms due to the numerous differential diagnoses and to exclude other intracranial pathology.

References
**Accurate Blood Pressure Measurement**

Proper measurement of blood pressure is essential for diagnosis and treatment in parturients. Most hospitals and clinic settings rely upon automated oscillatory measurements (automatic blood pressure cuff). Proper calibration of equipment should be verified on a set basis with biomedical personnel and validated against a mercury sphygmomanometer.  

Accurate blood pressure measurement remains a challenge secondary to poor cuff size fitting. In obese patients, the arm may have pronounced tronco-conical shape and rectangular cuffs may not fit properly. Tronco-conical cuffs should be considered for blood pressure measurement in obese patients with arm circumference greater than 50 cm=19.69 in. As an alternative to tronco-conical cuffs, the forearm method of measurement may be a more accurate alternative to upper arm measurement in morbidly obese patients when using a rectangular cuff. 

Invasive arterial blood pressure remains the gold standard for accurate blood pressure measurement, and a critical care consult may be considered if noninvasive blood pressure is not obtainable.

Steps for Obtaining an Accurate Blood Pressure Measurement: 

1. **Gather equipment:**
   a. Use a validated automatic or manual blood pressure cuff and have a full range of cuffs available.
   b. Check cuff for any defects.
   c. Obtain correct size cuffs: length of cuff 80% of arm circumference and width of cuff 40% of arm circumference (length-to-width ratio 2:1).

2. **Prepare the patient:**
   a. Patient to be sitting or in semi-recumbent position (semi-fowler’s position)
   b. Cuff should be at the level of the heart
c. Feet should be flat on the floor, not dangling unsupported from the bed or exam table, and legs uncrossed
d. Patient should be sitting quietly for 10 minutes with minimal distractions
e. Assess any recent consumption of caffeine or nicotine. If blood pressure levels are within treatment range, do not delay antihypertensive therapy.

3. Take measurement:
   a. Support patients arm at heart level or seated in semi-fowlers position (head of bed at 30-40 degrees); if in bed legs below the level of the heart.
   b. Instruct the patient not to talk during the reading
   c. Utilize standard method for blood pressure machine and or manual measurement an proper placement of cuff
   d. For auscultatory measurement: locate the brachial pulse and place diaphragm of stethoscope over brachial artery. Use first audible sound (Kortokoff I) as systolic pressure and disappearance of sound (Kortokoff V) as diastolic pressure.
   e. Read to the nearest 2 mm Hg.
   f. **Do not reposition the patient to either side to obtain a lower blood pressure. This action will give you a falsely low reading.**
   g. If blood pressure is elevated, take another blood pressure within 15 minutes and use the highest blood pressure reading.
   h. If blood pressure is equal to or greater than 140/90, repeat within 15 min, and if still elevated, initiate evaluation for preeclampsia.

4. Record Measurement:
   a. Document blood pressure, patient position, arm and cuff size

5. Additional Special Considerations for Obese Patients:
   a. For upper arms greater than 50 cm, the AHA recommends using a cuff on the forearm and feeling for the appearance of a radial pulse to estimate systolic blood pressure. (The accuracy may not be reliable).[^6]
   b. Thigh cuffs may be considered in women with large upper arms

---

[^6]: Reference to measurement accuracy in obese patients.
Key Learning points:

1. Have an assortment of cuffs available.
2. Make sure your equipment is regularly calibrated.
3. Use the appropriate size cuff.
4. Position the patient properly.
5. In the obese patient consider thigh cuff, forearm measurement or tronco-conical cuff.
6. Record the higher blood pressure. Record cuff size, arm laterality and position.
7. Be consistent, and be present during blood pressure assessment to determine proper blood pressure technique: do not rely on “auto cycle”.
8. Follow up on elevated blood pressure of 140/90 or greater within 15 min.

**Recommended cuff sizes:**

<table>
<thead>
<tr>
<th>Arm Circumference (cm)</th>
<th>Cuff Size (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-26</td>
<td>Small adult: 12 x 22</td>
</tr>
<tr>
<td>27-34</td>
<td>Adult: 16 x 30</td>
</tr>
<tr>
<td>35-44</td>
<td>Large Adult: 16 x 36</td>
</tr>
<tr>
<td>45-52</td>
<td>Adult Thigh: 16 x 42</td>
</tr>
</tbody>
</table>
Pitfalls with improper cuff placement:

<table>
<thead>
<tr>
<th>Increase in BP</th>
<th>Decrease in BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too small cuff</td>
<td>Too large cuff</td>
</tr>
<tr>
<td>Cuff not over brachial artery</td>
<td></td>
</tr>
<tr>
<td>Brachial artery above heart</td>
<td></td>
</tr>
<tr>
<td>Cuff over clothing</td>
<td></td>
</tr>
<tr>
<td>Arm below heart and not supported</td>
<td></td>
</tr>
</tbody>
</table>

Pitfalls of improper patient positioning:

<table>
<thead>
<tr>
<th>Increase in BP</th>
<th>Range of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossed legs</td>
<td>(Systolic +2-8 mm Hg)</td>
</tr>
<tr>
<td>Unsupported back</td>
<td>(Diastolic +6 mm Hg)</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>(Systolic +10-12 mm Hg)</td>
</tr>
<tr>
<td>Patient talking</td>
<td>(Systolic +8-15 mm Hg)</td>
</tr>
</tbody>
</table>
References
EARLY RECOGNITION AND TREATMENT OF PREECLAMPSIA/ECLAMPSIA

Background
Rates of maternal mortality and morbidity are increasing in the United States, and are at levels twice as high as those of Western Europe. In the United States, the California Maternal Mortality Review 2002-2003 identified early recognition and treatment of vital signs and symptoms of preeclampsia as a critical factor in reducing maternal mortality and morbidity. Missed “triggers” such as elevated blood pressure, headache, or deteriorating status occurred in 60% of preeclampsia deaths. The failure to treat and comprehend deteriorating patient status coupled with a lack of escalation of care has led to preventable maternal mortality.

In 2003-2005, the United Kingdom’s Confidential Enquiries into Maternal and Child Health report recommended the introduction of the modified early obstetric warning system (MEOWS) for obstetric patients to track physiologic parameters to aid in early recognition and treatment of parturients. This bedside tool serves as a screening tool for assessment and escalation of care for vital signs, and symptom parameters (see figure below). A validation study in 2012 has shown the MEOWS to have an acceptable sensitivity and specificity and has prompted the United Kingdom to support its continued use.

In 2010, the Joint Commission issued a Sentinel Alert, “Preventing Maternal Death”, which recommended that all centers have a process in place for recognition and response to a patient’s deteriorating condition with written criteria describing early warning signs and indicating when to seek further assistance.

In 2014, in the United States, the National Partnership for Maternal Safety launched a nationwide call to action to reduce maternal mortality. Hypertension in pregnancy, along with hemorrhage and thromboembolism were identified as high priority disease processes, and in 2015, the Hypertension Patient Safety bundle was released.

The Hypertension in Pregnancy Patient Safety Bundle recommends that every birthing facility incorporate a standard approach to severe hypertension. The safety bundles outline recommended protocols and materials directed towards readiness, recognition, response and reporting of severe hypertension in pregnancy. Each facility is to individualize their particular policies/protocols to local resources. Two essential components are inherent in readiness for hypertensive emergencies: Maternal early warning criteria based on vital signs and or symptoms, and an effective escalation policy.

With the current use of electronic medical records, early warning systems can be incorporated into algorithms to aid in early recognition, treatment and escalation of care. Scoring tools that indicate when to escalate care can help guide interventions in response to changing patient condition and can be incorporated into electronic patient records (see figure below). Further studies to determine specific parameters to improve sensitivity, specificity and predictive values will help to improve clinical utility of early warning protocols.
Key Learning Points:
1. Missed vital sign triggers and failure to respond to change in vital signs can result in preventable morbidity and mortality.
2. The Modified Early Obstetric Warning System (MEOWS) is an effective system to aid in early recognition of maternal physiological decompensation.
3. The National Patient Safety Hypertension in Pregnancy safety bundle recommends early maternal warning criteria for hypertension and an effective escalation policy.
4. Each birthing facility should implement written protocols that are tailored to available resources to satisfy safety bundle requirements for readiness, recognition, response and reporting of severe hypertension in pregnancy.
5. The use of electronic medical records offers a unique opportunity to incorporate an early warning system for hypertension in pregnancy.

References
EARLY RECOGNITION TOOL

Preeclampsia Early Recognition Tool (PERT)

<table>
<thead>
<tr>
<th>ASSESS</th>
<th>NORMAL (GREEN)</th>
<th>WORRISOME (YELLOW)</th>
<th>SEVERE (RED)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Agitated/Confused</td>
<td>Unresponsive</td>
</tr>
<tr>
<td>Awareness</td>
<td>None</td>
<td>Difficulty speaking</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>None</td>
<td>Nausea, vomiting</td>
<td></td>
</tr>
<tr>
<td>Vision</td>
<td>None</td>
<td>Blurred or impaired</td>
<td>Temporary blindness</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>100-139</td>
<td>140-159</td>
<td>≥160</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>80-89</td>
<td>90-105</td>
<td>≥105</td>
</tr>
<tr>
<td>HR</td>
<td>60-110</td>
<td>111-129</td>
<td>≥130</td>
</tr>
<tr>
<td>Respiration</td>
<td>11-24</td>
<td>25-30</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>SOB</td>
<td>Absent</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>O2 Sat (%)</td>
<td>&gt;95</td>
<td>91-94</td>
<td>89</td>
</tr>
<tr>
<td>Pain: Abdominal or Chest</td>
<td>None</td>
<td>Nausea, vomiting</td>
<td>Nausea, vomiting</td>
</tr>
<tr>
<td>Fetal Signs</td>
<td>Category I Reactive NST</td>
<td>Category II UGR Non-reactive NST</td>
<td>Category III</td>
</tr>
<tr>
<td>Urine Output (ml/24h)</td>
<td>≥500</td>
<td>30-49</td>
<td>≤30 (in 2 hrs)</td>
</tr>
<tr>
<td>Proteinuria (trace is normal; proteinuria indicates pregnancy toxemia)</td>
<td>Traces</td>
<td>&gt; +1**</td>
<td>&gt; +2/300/mg/24 hours</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt;100</td>
<td>50-100</td>
<td>&lt;50</td>
</tr>
<tr>
<td>AST/ALT</td>
<td>&lt;70</td>
<td>&gt;70</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Creatinine</td>
<td>&gt;0.8</td>
<td>0.9-1.1</td>
<td>&gt;1.2</td>
</tr>
<tr>
<td>Magnesium Sulfate Toxicity</td>
<td>DTR +1</td>
<td>Respiration 10-20</td>
<td>Depression of patellar reflexes</td>
</tr>
</tbody>
</table>

YELLOW = WORRISOME
Increase assessment frequency

YELLOW = WORRISOME

RED = SEVERE
Trigger: 1 of any type listed below

TO DO

1 of any type
Immediate evaluation
Transfer to higher acuity level
1:1 staff ratio
Awareness
Consider Neurology consult
CT Scan
BPP
Laboratory/diuretics in 30 min
In-person evaluation
Magnesium sulfate loading or maintenance infusion
Headache
Consider CT angiogram
Hypertension
SOB
O2 at 10 L per minute
Respiratory distress
O2 Sat
Chest x-ray

GREEN = NORMAL
Proceed with protocol

**Physician should be made aware of worsening or new-onset proteinuria


Note: The FPQC recommends in-person evaluation should be done when yellow “worrisome” zone has been reached. In addition to a nonreactive NST, a non-reassuring BPP of the fetus should also be considered worrisome.
PATIENT SAFETY BUNDLE: HYPERTENSION

COUNCIL ON PATIENT SAFETY IN WOMEN’S HEALTH CARE
safe health care for every woman

READINESS

Every Unit

- Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms)
- Unit education on protocols, unit-based drills (with post-drill debriefs)
- Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage.
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

RECOGNITION & PREVENTION

Every Patient

- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CBC with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women’s Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women’s Health Care is a broad consortium of organizations across the spectrum of women’s health for the promotion of safe health care for every woman.

For more information visit the Council's website at www.safehealthcareforeverywoman.org

May 2015
**RESPONSE**

Every case of severe hypertension/preeclampsia
- Facility-wide standard protocols with checklists and escalation policies for management and treatment of:
  - Severe hypertension
  - Eclampsia, seizure prophylaxis, and magnesium over-dosage
  - Postpartum presentation of severe hypertension/preeclampsia
- Minimum requirements for protocol:
  - Notification of physician or primary care provider if systolic BP $\geq$ 160 or diastolic BP $\geq$ 110 for two measurements within 15 minutes
  - After the second elevated reading, treatment should be initiated ASAP (preferably within 60 minutes of verification)
  - Includes onset and duration of magnesium sulfate therapy
  - Includes escalation measures for those unresponsive to standard treatment
  - Describes manner and verification of follow-up within 7 to 14 days postpartum
  - Describe postpartum patient education for women with preeclampsia
- Support plan for patients, families, and staff for ICU admissions and serious complications of severe hypertension

**REPORTING/SYSTEMS LEARNING**

Every unit:
- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of all severe hypertension/eclampsia cases admitted to ICU for systems issues
- Monitor outcomes and process metrics

Note: “Facility-wide” indicates all areas where pregnant or postpartum women receive care. (E.g. L&D, postpartum critical care, emergency department, and others depending on the facility).

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women’s Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

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For more information visit the Council’s website at www.safehealthcareforeverywoman.org

May 2015

Used with permission from the Council on Patient Safety in Women’s Care. Hypertension Patient Safety Bundle 2015
Figure: The Maternal Early Warning Criteria (MEWC)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>&lt;90 or &gt;160</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Heart rate (beats per min)</td>
<td>&lt;50 or &gt;120</td>
</tr>
<tr>
<td>Respiratory rate (breaths per min)</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>Oxygen saturation on room air, at sea level, %</td>
<td>&lt;95</td>
</tr>
<tr>
<td>Oliguria, mL/hr for ≥2 hours</td>
<td>&lt;35</td>
</tr>
<tr>
<td>Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath</td>
<td></td>
</tr>
</tbody>
</table>

Figure: Obstetric Vital Sign Alert Algorithm

<table>
<thead>
<tr>
<th>In Range</th>
<th>Continue to monitor and assess patient at ordered intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score ≤2</td>
<td></td>
</tr>
</tbody>
</table>

**Assess Patient**

<table>
<thead>
<tr>
<th>Score 3-4</th>
<th>Check equipment function and troubleshoot as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perform assessment of patient, critically thinking about what in the patient's condition could be causing the score</td>
</tr>
<tr>
<td></td>
<td>View vital sign trend line</td>
</tr>
<tr>
<td></td>
<td>Implement Nursing Interventions as appropriate</td>
</tr>
<tr>
<td></td>
<td>Notify Charge Nurse of VSA score and trend</td>
</tr>
<tr>
<td></td>
<td>Document assessment, intervention and evaluation notes</td>
</tr>
</tbody>
</table>

Monitor vital signs at more frequent interval until they return to baseline and score is less than 3

**Take Action**

<table>
<thead>
<tr>
<th>Score 5-8</th>
<th>Check equipment function and troubleshoot as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perform assessment of patient, critically thinking about what in the patient's condition could be causing the score</td>
</tr>
<tr>
<td></td>
<td>View vital sign trend line</td>
</tr>
<tr>
<td></td>
<td>Notify Charge Nurse</td>
</tr>
<tr>
<td></td>
<td>Notify MD of patient score, condition, assessment</td>
</tr>
<tr>
<td></td>
<td>Implement nursing interventions and physician orders</td>
</tr>
<tr>
<td></td>
<td>Consider calling MRT</td>
</tr>
</tbody>
</table>

Monitor vital signs at more frequent interval until they return to baseline and score is less than 3

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PROTEINURIA

It is important to test for proteinuria in patients who are being evaluated for hypertension in pregnancy. There are several options for testing and clinicians should be aware of testing methods available in their practice settings. If you are evaluating a patient for hypertension, a urine dipstick should be obtained.

Proteinuria is diagnosed when a 24-hour urine excretion equals or exceeds 300 mg in 24 hours or the protein:creatinine ratio in a single voided urine measures or exceeds 0.3 (each measured in mg/dL). Qualitative dipstick readings of 1+ suggest proteinuria but have many false-positive and false-negative results and should be reserved for use when quantitative methods are not available or rapid decisions are required.\(^1,\,^2\)

Proteinuria is not absolutely required for diagnosis of preeclampsia for patients with findings suggestive of severe features (severe hypertension associated with end organ pathology e.g. thrombocytopenia, elevated liver enzymes, hemolysis, high creatinine). Delivery decisions should not be based on the amount of proteinuria or change in proteinuria.\(^1,\,^3\)

Isolated new onset proteinuria, especially in a patient with gestational hypertension, in the absence of urinary tract infection (UTI), is associated with a significantly increased risk for development of preeclampsia/atypical preeclampsia.\(^4\)

Recommendations for Quality Improvement

1. Urine dipstick is an acceptable initial screen if quantitative methods are not available. If positive (1+ or more) further evaluation is warranted.
2. 24-hour urine collection or protein: creatinine ratio should be used for diagnosis.
3. Do not delay care in order to obtain 24-hour urine results; proceed with treatment/management if other diagnostic criteria for preeclampsia are present.
4. Absence of proteinuria should not be used for ruling out preeclampsia. Preeclampsia, eclampsia, severe gestational hypertension, and/or HELLP syndrome, may occur without proteinuria.\(^3,\,^4\)
5. The amount of proteinuria should not be used to classify severity of preeclampsia or guide patient management except in special circumstances.\(^1\)
6. Obtain baseline 24-hour urine protein or validated equivalent from those patients with proteinuria present in early or pre-pregnancy. Use heightened surveillance, carefully evaluate for symptoms of severe preeclampsia, and monitor for an increase in excreted protein in this population.
7. The presence of new onset proteinuria in the absence of elevated blood pressure requires careful and more frequent patient surveillance (weekly to twice weekly) for the possible development of preeclampsia.\(^4,\,^6\)

References


ACUTE TREATMENT AND MANAGEMENT

DAILY ASSESSMENT FOR DELIVERY VERSUS CONTINUING PREGNANCY

Use this checklist to determine whether to consider delivery or to continue the pregnancy for women with preeclampsia with severe features.

If any of these clinical or laboratory criteria are checked, consider delivery.

- Persistent maternal headache
- Altered mental status
- Blurred vision or scotomata
- Shortness of breath or Pulmonary edema or Hypoxia O2 saturation < 95%
- Abdominal or epigastric pain
- Vaginal bleeding
- Persistent BP ≥ 160 Hg systolic or ≥ 110 Hg diastolic despite medical treatment
- Oliguria < 500 mL in 24 hours
- Creatinine > 1.1 mg/dL or Doubling of creatinine
- Thrombocytopenia < 100,000 /μL
- ALT > 70 or 2x upper limit of normal
- Hemolysis (LDH > 600 U/L, total bilirubin > 1.2 mg/dL, schistocytes on peripheral smear)
- Coagulopathy (Elevated PT/PTT or INR Fibrinogen < 300 mg/dL)
- Abnormal NST or BPP
- Oligohydranmios > 34 weeks gestation AFI < 5
- Fetal growth restriction > 34 weeks gestation. Estimate weight < 5%

If no to all, continue pregnancy.

NURSING MANAGEMENT AND ASSESSMENT

We recommend institutions review the section “Ante, Intra, Postpartum Nursing Management and Assessment of Preeclampsia: Maternal/Fetal Assessment and Monitoring Recommendations” in the CMQCC Preeclampsia Toolkit, pages 36-39.
Outpatient Management of Preeclampsia

Outpatient management of preeclampsia is safe if the correct patients are selected (including criteria for compliance, maternal and fetal surveillance, monitoring with clear instructions regarding danger signs). If in doubt, admit the patient to the hospital for observation to determine if there is preeclampsia with severe features, or other indicators of maternal or fetal compromise. At the time of admission antenatal glucocorticoids are typically administered to enhance fetal lung maturation if the pregnancy is less than 34 weeks gestation. If the patient is 37 weeks or greater in gestational age, delivery is performed as the benefits of further expectant management are not demonstrable and potentially hazardous for both the patient and the infant at or beyond this gestational age.\(^1\)

In patients less than 37 weeks gestation who meet appropriate criteria, the benefits to outpatient management allow for a more comfortable and convenient means of extending the pregnancy without the displacement of the patient to the hospital and without the attendant risks of hospitalization (maternal stress, iatrogenic infection, thromboembolism).\(^2\)

Should hospitalization prior to 34 weeks gestation need to be considered, transfer to a tertiary care facility may be appropriate given the potential need for delivery of a preterm infant.

Whether the patient is at home or in the hospital, she should be made aware to inform her health care provider of symptoms or signs that warrant concern: headache, abdominal or epigastric pain, visual disturbances, vaginal bleeding or decreased fetal movement. If she is not able to communicate to her provider because of lack of understanding or inability to communicate (including limited telephonic resources) admission is advisable.

Outpatient management of preeclampsia can be considered if the following criteria are met:\(^1,^3\)

**Maternal stability**
- Gestational age < 37 weeks
- No indicators of severe features of preeclampsia

At 37 weeks delivery should be considered
- None of the following maternal symptoms:
  - Headache, visual disturbances, abdominal pain, gastrointestinal symptoms
  - BP in the non-severe range
  - No evidence of hemolysis
  - Normal or near normal lab assessment

* Recognize that the majority of contributors to the FPQC’s HIP Initiative feel that a margin of safety in terms of hypertension should be considered when offering outpatient management. A systolic < 150 mm Hg and a diastolic < 100 mm Hg is recommended.

**Fetal stability**
- Appropriate fetal growth
- Reassuring antenatal fetal testing
- Normal amniotic fluid volume
**Ability to be followed as an outpatient**

Communicative and reliable patient

Twice weekly assessment:

- Maternal blood pressure
- Maternal protein assessment
  - Laboratory assessment for indicators of worsening disease
  - Fetal testing including amniotic fluid assessment
  - Periodic ultrasound assessment of fetal growth

Weekly assessment of liver enzymes & platelets

Bed rest is typically not advocated, to limit the risk for thromboembolism. Resting or sleeping in the lateral decubitus position as opposed to the supine position is preferable.  

Protein determinations can be made by a urine protein creatinine ratio (≥ 0.3 mg/dL/mg/dL) or ≥ 300 mg on a 24 hour urine protein collection or a dip stick reading of 1+ if no other methods are available. Increasing proteinuria warrants more careful assessment of the patient, although in and of itself is not an indication for delivery.

Again, for any sign or symptom of severe disease, the patient should be admitted and a delivery plan established. We do not distinguish management of gestational hypertension from that of preeclampsia in this document suggesting surveillance to be similar in both instances. Features of severe disease are managed accordingly, whether the patient has gestational hypertension or preeclampsia. Initiation of antihypertensive medication is not recommended in the outpatient setting.

References

ANTIHYPERTENSIVE THERAPY IN PREECLAMPSIA

Hypertensive disease, as well as the potentially related disorders of cardiomyopathy and cerebrovascular accidents, contribute to a sizeable percentage of maternal deaths in Florida. Prompt recognition and effective management are the keys to reducing maternal morbidity and mortality. The American College of Obstetricians & Gynecologists has made risk reduction and safe outcomes a priority for women with acute onset severe hypertension during pregnancy and in the postpartum period.\(^1,2\)

A systolic blood pressure of 160 mm Hg or a diastolic blood pressure of 110 mm Hg are recognized levels mandating treatment to prevent neurologic injury. The practitioner may be aware this sense of urgency differs from that of the non-pregnant population. The systolic blood pressure, more than the diastolic pressure or the rate of increase of either, is accepted for being the predominant risk factor for maternal stroke.\(^1,3\)

The concern for this degree of hypertension during the pregnancy or postpartum is the loss of the ability of the cerebral circulation to auto-regulate itself.\(^1,2\) The cerebral circulation attempts to provide a constant flow of blood through pressure regulation. With severe hypertension the protection of the cerebral vasculature is overwhelmed.

Complications
As previously mentioned, maternal cerebrovascular accident is a potential complication of a hypertension emergency. Awareness of the patient’s mental status and focal neurologic findings should remain on the provider’s mind. Two other potentially fatal complications include reversible posterior leukoencephalopathy syndrome and pulmonary edema.

Reversible posterior leukoencephalopathy syndrome is a neurologic complication most frequently encountered in pregnancy in the setting of preeclampsia/eclampsia.\(^4,5,6\) Vasogenic edema occurs in the posterior cerebral white matter due to impaired cerebral autoregulation as well as capillary leak. Control of blood pressure and seizure prevention are emphasized in its management. Neuroimaging of the brain is important; however, the sensitivity of computed tomography is only 50\%.\(^5\) Thus magnetic resonance imaging is more useful for this diagnosis. Neurology consultation is warranted.

Pulmonary edema is another complication of a hypertensive emergency, attributable to impaired relaxation of the left ventricle during diastole (heart failure with preserved left ventricular ejection fraction), left ventricular systolic dysfunction, or non-cardiogenic pulmonary edema due to capillary leak or low oncotic pressure. The principles of management include administration of oxygen, fluid restriction, diuresis, control of blood pressure and evaluation of the cardiac dysfunction with chest x-ray and echocardiography.

Goals of Treatment
It is important to lower blood pressure effectively yet judiciously. In a hypertensive emergency a key concept in blood pressure control is to not lower the blood pressure too rapidly causing an ischemic stroke or uteroplacental insufficiency. As a general rule, blood pressure, as measured in terms of mean arterial pressure, should not be lowered more than 15-20% in the first 1-2 hours.\(^7\) Remember the
The goal is not to “normalize” the blood pressure, but rather to control it. Correspondingly, if a patient were to present with excessively high blood pressure, the goals of initial therapy would be to lower the pressure to values that might seem otherwise high.

The mean arterial pressure can be calculated using the following formula:
Mean arterial pressure = Diastolic pressure + \[\frac{1}{3} \times (\text{Systolic pressure} - \text{Diastolic pressure})\]

Over the next 23 hours, the blood pressure can be safely lowered another 10 – 15%. As a cautionary note, if the diagnosis is aortic dissection (tearing chest pain for example in a patient with a collagen disorder) or ischemic stroke (focal weakness, numbness, imbalance, visual loss) the management of the hypertension is more aggressive in the former and less so in the latter. Consultation would be required.

For the majority of patients, a desirable range of blood pressure would be:
- Systolic 140 -150 mm Hg and
- Diastolic 90 – 100 mm Hg

An additional cautionary note is to control the blood pressure before delivery and in particular, before endotracheal intubation, should general anesthesia be required.

**Antihypertensive Agents**

Although not considered an antihypertensive agent, magnesium sulfate should be administered for prevention and control of eclamptic seizures. Local practice considerations should be reviewed as well as additional evidence in incorporating this recommendation into local protocols.

Intravenous agents including labetalol and hydralazine are the most popularly used agents in this setting. The chart that follows offers order sets using labetalol, hydralazine or nifedipine as first line therapies. The former two require intravenous administration. If intravenous access is delayed, oral nifedipine can be used or oral labetalol (200 mg initially then repeated in 30 minutes if needed for further control). Concomitant use of magnesium sulfate with a calcium channel blocker warrants caution for neuromuscular blockade and uncontrolled hypotension despite reassuring reports in the literature.

Finally, if the above agents are unsuccessful at achieving blood pressure control within a reasonable period of time, intravenous nicardipine is an effective second line agent. It is given as an intravenous infusion beginning at 2.5 mg/hour and increasing by 2.5 mg every 15 minutes to a maximum dose of 15 mg/hour. As an intravenous infusion, some centers opt for continuous blood pressure monitoring utilizing arterial line placement.

References

MAGNESIUM SULFATE

Several major organizations support the use of Magnesium Sulfate for seizure prophylaxis in preeclampsia with severe features. This has been shown to be more effective than other agents. Although ACOG has suggested magnesium sulfate not be used for preeclampsia with mild features, other organizations such as WHO and Society of Obstetricians and Gynaecologists of Canada support its use (SOGC). Eclampsia is a frequent cause of maternal death; 10% of those who suffer an eclamptic convulsion may be expected to die. The 2010 Cochrane Review on the subject and the MAGPIE trial conclude that magnesium sulfate should be utilized in mild preeclampsia. Unfortunately, we are not able to accurately predict which preeclamptic patient will have an eclamptic convulsion. In a recent publication on the subject, Berhan and Berhan showed “Out of 3443 eclamptic women, 25% were normotensive; 20% had mild-to-moderate hypertension; 32% had severe hypertension; and 21% were hypertensive but unclassified. Out of 2163 eclamptic women, 66% and 27% had a headache and visual disturbance, respectively, preceding the occurrence of convulsion. Out of 2053 eclamptic women, 25% had epigastric area pain, and out of 1092 women with eclampsia, 25% were asymptomatic.” Because of data such as this, our committee feels a more individualized approach regarding Magnesium Sulfate is advised—local considerations and practice guidelines and more recent evidence should be reviewed and protocols developed to implement use. If the patient demonstrates a more benign course, then the magnesium sulfate may be discontinued.

While magnesium sulfate is being administered during the peripartum period, fluid intake and output should be monitored, and signs of magnesium toxicity observed and managed.

As many facilities have moved to more automated medication dispensing systems (i.e. Pyxis), the Eclampsia box referred to in the tool kit may present difficulties. An alternative approach is to create an “Obstetric Code Cart” maintained through the pharmacy that contains the medications used for eclampsia, severe hypertension, and obstetrical hemorrhage. It could have separate drawers for hemorrhage and severe preeclampsia/eclampsia. It should be a different color that would separate it from the code cart. It should be maintained just as a code cart is so it is a ready resource. Algorithms such as provided in this tool kit should be prominently displayed on the cart and easily available at the bedside.

The CMQCC Preeclampsia Toolkit section on Magnesium Sulfate, pages 51-57, provides specific guidelines and recommendations.
References


5. Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA. Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care) Developed under contract #11-10006 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative, November 2013.
**Hypertension Emergency Algorithm**

**Hypertension Emergency**
Systolic Blood Pressure ≥ 160 mm Hg
Diastolic Blood Pressure ≥ 110 mm Hg

**Magnesium Sulfate Seizure Prophylaxis**
4 to 6 g IV load over 20 minutes then 1-2 g per hour continuous infusion for 24 hours
10 g IM injection (5 g into each buttocks + 1 cc 1% lidocaine) then 5 g every 4 hours (if no IV)

**First Line Agents**
- IV Labetalol
- IV Hydralazine
- Oral Nifedipine

**Use with caution when**
- **Labetalol**
  - Heart rate < 60 bpm,
  - Congestive heart failure,
  - AV heart block, or asthma
- **Hydralazine**
  - Heart rate > 100 bpm,
  - Recent stroke,
  - Severe mitral valve disease
- **Nifedipine**
  - Heart rate > 100 bpm, Severe aortic stenosis, Recent MI, cardiogenic shock

**Preferred agent when**
- **Labetalol**
  - Maternal tachycardia
- **Hydralazine**
  - Maternal bradycardia
- **Nifedipine**
  - Maternal bradycardia or oliguria

Check blood pressure every 20 minutes (10 minutes if labetalol)
Continue if SBP ≥ 160 mm Hg or DBP ≥ 110 mm Hg

**Labetalol (q 10 min)**
- **Initial:**
  - 20 mg IV over 2 minutes
- **Second:**
  - 40 mg IV over 2 minutes
- **Third:**
  - 80 mg IV over 2 minutes
- **If BP remains elevated, then switch to**
  - Hydralazine starting at 10 mg IV push

**Hydralazine (q 20 min)**
- **Initial:**
  - 5 to 10 mg IV over 2 minutes
- **Second:**
  - 10 mg IV over 2 minutes
- **If BP remains elevated, then switch to**
  - Labetalol 20 mg IV push
  
  - If needed, Labetalol 40 mg IV push

**Nifedipine (q 20 min)**
- **Initial:**
  - 10 mg by oral route
- **Second:**
  - 20 mg by oral route
- **Third:**
  - 20 mg by oral route
- **If BP remains elevated, then switch to**
  - Labetalol starting at 40 mg IV push

**Second Line Agent, Intravenous Nicardipine**
- 2.5 to 5 mg per hour and titrate to effect, maximum 15 mg per hour
MANAGEMENT OF ECLAMPSIA ALGORITHM

Call for help and request immediate obstetrical and anesthesiology bedside evaluation

Monitor maternal vital signs and fetal heart rate

Control of Hypertension
- Please see accompanying Hypertension Emergency Algorithm
- Secure airway by:
  - Jaw thrust/head-tilt-chin-lift
  - then insert oral airway (OA)
- Insert nasal airway if:
  - obstruction or unable to insert OA
- Using suction, clear airway free of secretions
- Administer 100% oxygen via Non-rebreather face mask
- If apnea present, ventilate with amбу bag
  
To prevent aspiration, place in left lateral and Trendelenberg position
- Obtain intubation equipment and be prepared to place endotracheal tube, if needed

Airway and Breathing
- Secure airway by:
  - Jaw thrust/head-tilt-chin-lift
  - then insert oral airway (OA)
- Insert nasal airway if:
  - obstruction or unable to insert OA
- Using suction, clear airway free of secretions

Controlling seizure
- Start magnesium sulfate as a 6 g bolus over 20 minutes and maintain continuous infusion at 1 - 2 g per hour
- If convulsions persist and the patient is already on magnesium then bolus 2 g over 3 to 5 minutes
- If convulsions persist, then consider other causes for status epilepticus, and obtain:
  - Anesthesia consultation for possible IV propofol (20 - 40 mg) and rapid sequence intubation
  - May also consider emergent neurology consultation & imaging

Monitor Fetal Heart Rate
- Consultation with Ob and Anesthesia to determine timing for delivery
  - Fetal bradycardia is Common.
  - If appropriate, Allow FHR to recover deferring emergent delivery for persistent bradycardia

Other medications used to control seizures include:
- Lorazepam, 2 - 4 mg IV and repeat times one in 10 - 15 minutes
- Diazepam, 5 - 10 mg IV and repeat every 10 - 15 minutes (maximum dose 50 mg)
- Phenytoin, 15 - 20 mg/kg IV and repeat in 20 minutes (avoid in hypotension, watch for arrhythmias)
- Keppra, 500 mg IV or PO, repeat times one in 12 hours (adjust if renal impairment)
HYPERTENSIVE EMERGENCY IN PREGNANCY SAMPLE MEDICATION LIST

Each institution should have immediate access to medications via automated dispensary cabinet or pharmacy approved medication kit. Medications should be specific to treatment protocols. Coordination with the Pharmacy Department to insure proper dosage, availability and inventory is encouraged.

Medications should be immediately available in Triage, L & D, Antepartum, Postpartum and Emergency Department areas. Please refer to Hypertension Emergency Treatment Algorithm if maximum doses are reached and further escalation of treatment is needed.

ANTIHYPERTENSIVE

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labetalol</td>
<td>IV</td>
<td>20 mg, then 40-80 mg every 10 min (Max dose 220mg) See algorithm for second line medication</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>IV</td>
<td>5-10 mg every 10 min (Max dose 25 mg) See algorithm for second line medication</td>
</tr>
</tbody>
</table>
| Nicardipine | IV    | Infusion 2.5-5 mg/h, increase by 2.5 mg/h every 5 min (Max dose 15 mg/h) 
| Esmolol   | IV    | 1-2 mg/kg IV over 1 min (ANESTHESIA ONLY)                                |
| Labetalol | PO    | 200 mg may repeat in 30 min (if no IV access)                          |
| Nifedipine | PO    | 10 mg, 20 mg, 20 mg may repeat in 30 min (if no IV access) (Max dose 50 mg). See algorithm for second line medication |

SEIZURE PROPHYLAXIS

Monitor Magnesium levels and deep tendon reflexes

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Sulfate (10%)</td>
<td>IV</td>
<td>Loading Dose: 4-6 g over 20 min Maintenance: 1-2 g/h continuous for 24 hours</td>
</tr>
<tr>
<td>Magnesium Sulfate (50%)</td>
<td>IM</td>
<td>5g in each buttock (if no IV access) Maintenance: 5 g in buttock every 4 hours</td>
</tr>
</tbody>
</table>

PERSISTENT SEIZURES

Consider Anesthesia/ICU/Neuro consult and airway management

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Sulfate (20%)</td>
<td>IV</td>
<td>After bolus dose: 2 g</td>
</tr>
</tbody>
</table>


Propofol (Off-label use)  IV  30-40 mg bolus (ANESTHESIA ONLY)
Midazolam (Off-label use)  IV  1-2 mg repeat 10 min X 3 dose
Lorazepam  IV  2 mg repeat 15 min X 4 doses (Max dose 8 mg)
Diazepam  IV  5-10 mg (Max dose 30 mg)
Levitracetam  IV  500 mg every 12 hours

**MAGNESIUM TOXICITY**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Gluconate</td>
<td>IV</td>
<td>1 g over 10 min</td>
</tr>
</tbody>
</table>

**ACUTE PULMONARY EDEMA**

Consider Anesthesia/ICU consult and airway management

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furosemide</td>
<td>IV</td>
<td>10-40 mg X 1; may be increased by 20 mg every 2 Hours (Max dose 200 mg/dose)</td>
</tr>
</tbody>
</table>

**ANTENATAL STEROIDS FOR FETAL LUNG MATURITY**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route</th>
<th>Dose (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betamethasone</td>
<td>IM</td>
<td>12 mg every 24 hours X 2 doses</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>IM</td>
<td>6 mg every 12 hours X 4 doses</td>
</tr>
</tbody>
</table>

References:

2. ACOG Committee Opinion No. 623. Emergent Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period.
AIRWAY MANAGEMENT DURING SEIZURES

See “Airway Management in Pregnant or Postpartum Women Having Seizures” in the CMQCC Preeclampsia Toolkit, pages 75-77.

FLUID MANAGEMENT

It is essential that fluid balance is closely monitored.
• Total fluid input of 80 - 100 mL/hr, except for acute replacement of blood loss.
• Infused drugs should be administered in concentrated solutions.
• Insert Foley catheter and assess fluid output hourly.
• If urine output <20 mL/hour notify obstetrician for assessment of fluid balance.
• If after 4 hours urine output <80 mL inform obstetrician to review patient.
• If anuria (no urine output over 1 hour) at any point request review by obstetrician and assessment of fluid balance.
• Management plan should be documented in progress notes.

Colloids should NOT be used for intravascular volume expansion without central line to document wedge pressure. Use crystalloids 500ml over 1 hour with continuous oxygen saturation monitoring. If oxygen saturation is lower than 95% notify obstetrician. Any further fluid administration should be very cautious because the preeclamptic patient is very readily overloaded. Pulmonary edema kills but oliguria and renal tubular acidosis does not.

Fluid should be given according to the protocol flow chart below.
Figure: Royal Cornwall Hospital Trust Clinical Guidelines for the Management of Severe Preeclampsia Eclampsia

80 – 100 ml crystalloids / hour  
NB. Reduce if other infusions e.g. Mg SO₄  
80 – 100 ml TOTAL fluid / hour = ‘maintenance’

Urine Output  
≥ 80ml / 4 hrs

Continue maintenance of fluids

Urine Output  
<80 ml / 4 hrs

250 ml crystalloids over 15 min (if O₂ sats and chest exam are OK)

Urine output  
>20 ml over next hr

Repeat 250 ml crystalloids over 15 min (only if O₂ sats and chest exam are OK)

If <20 ml / hr, discuss with consultant anesthetist or intensivist. To consider CVP to guide further fluid management

If oliguria persists, repeat U & E’s and consider nephrology input

Urine output remains <20 ml over next hr
**SPECIAL CIRCUMSTANCES**

Please see the CMQCC Preeclampsia Toolkit section “Special Circumstances: Severe Preeclampsia at <34 Weeks,” pages 78-86.

**COMMUNICATION AND TEAMWORK**

We recommend hospitals review the “Teamwork and Communication” on pages 60-69 in the CMQCC Toolkit to review techniques.

**SIMULATIONS AND DRILLS**

The CMQCC Preeclampsia Toolkit present some examples of simulations and drills that can be used. While these examples use hi-fidelity models, the scenarios can be adapted for lower resource settings. Please see their Simulations/Drills: Appendices G-N, downloadable from their website.

**CONSULTATION TRIGGERS**

We recommend institutions review pages 87-88 in the CMQCC Preeclampsia Toolkit on “Consultation Triggers in Severe Preeclampsia for all Obstetric Units.”

**SAMPLE NURSING POLICY AND PROCEDURE**

We recommend Appendix U on page 131 of the CMQCC Preeclampsia Toolkit, “Sample Nursing Management Policy and Procedure.”
EMERGENCY DEPARTMENT

EMERGENCY DEPARTMENT RECOGNITION AND TREATMENT

Focus on Recognition of Hypertensive Disorders in Pregnancy and Delayed Postpartum

In Florida, hypertensive disorders accounted for 15.5% of pregnancy-related deaths from 1999-2012, representing one of the leading causes of maternal death. Additionally, hypertensive disorders are proven to be a significant characteristic associated with an increased risk of maternal morbidity. With up to 26% of eclamptic seizures occurring beyond 48 hours and as late as 4-6 weeks postpartum, it is not uncommon for these patients to present to the Emergency Department (ED). There is significant value in making a primary effort to properly educate patients on the emergency signs and symptoms of preeclampsia in order to encourage seeking medical care promptly, perhaps improving the chances of survival. However, as women of childbearing years, who may be pregnant or have recently delivered a child present in the ED, proper assessment and identification of preeclampsia becomes essential and may involve a thorough investigation of history via questioning the patient or the patient’s family. Women of childbearing age that present with common symptoms of preeclampsia should be questioned about a current or recent pregnancy. Additionally, it is imperative that Emergency Department personnel be comfortable with diagnosis of and initial management of these cases and prompt obstetric consultation is always necessary. Nevertheless, when pregnant or postpartum patients present with seizures Central Nervous System pathology should not be discounted and subsequent evaluation pursued, especially if the patient is well into the postpartum period.

Recommendations for Quality Improvement

1. ED triage protocols must include identifying patients who are currently pregnant or have delivered in the previous six (6) weeks. This information must be clearly communicated to the treatment team.
2. ED personnel should be familiar with the risk factors and characteristics of delayed postpartum preeclampsia and eclampsia.
3. Do not overlook other neurologic causes of seizure, particularly if the seizure occurs more than 48 hours after delivery.
4. Implementation of the protocol for diagnosis and treatment of preeclampsia and eclampsia in the Emergency Department. This can be reinforced through the use of educational tools in other sections of this toolkit and with the use of drills and simulations.
5. An opportunity for improvement may exist for hospitals to provide education to their Emergency Medical Services providers on the assessment, identification and treatment of women who may have seized due to eclampsia with a current pregnancy or postpartum eclampsia.

References

5. Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA. Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care) Developed under contract #11-10006 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative, November 2013.
6. Meyer, Mark, MD. Emergency Department Recognition and Treatment: Focus on Delayed Postpartum Preeclampsia and Eclampsia. In Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA. Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care), November 2013.
Reproduced from the CMQCC Preeclampsia Toolkit “Diagnosis: Evaluation and Treatment of Antepartum and Postpartum Preeclampsia and Eclampsia in the Emergency Department.”
PATIENT COUNSELING AND EDUCATION

Background
Hypertensive disorders were the third most common cause of pregnancy-related deaths in Florida from 2007-2012.¹ Interventions for women with preeclampsia in the prenatal period include increased monitoring, magnesium sulfate, antihypertensive medications and corticosteroids for fetal lung maturation, if indicated. To maximally benefit from these resources, however, women must first seek care in a timely fashion.

In Florida during the period 2009-2013, the leading patient factors among women who died from hypertensive disorders were: personal decisions (delay in seeking care) 47%, lack of knowledge regarding the severity of a symptom or condition 33%, and significant co-morbidity 20%.

The symptoms of preeclampsia and related disorders of pregnancy (e.g., eclampsia, HELLP syndrome) are usually considered non-specific and thus may not be recognized by the woman and her family as special concerns in pregnancy. Hence, women are less likely to seek care if they do not understand the signs and symptoms of preeclampsia or recognize them as concerns.

Studies show women who are diagnosed with preeclampsia, and receive timely and proper monitoring, have fewer adverse events than those with delayed diagnosis.³ This knowledge deficit appears modifiable, regardless of literacy level or initial understanding of preeclampsia, as pregnant women who had acknowledged receiving information about the disease, demonstrated greater preeclampsia-specific knowledge.

Further, many patients and clinicians are unaware that preeclampsia can either occur or persist following delivery. In addition, the natural progression of postpartum hypertension includes an initial decrease in blood pressure (BP) within 48 hours, but BP rises again between three to six (3-6) days postpartum.⁵ Preeclampsia may occur up to six (6) weeks postpartum.⁶ ⁷ In cases of late postpartum eclampsia, researchers found that nearly all of the patients had at least one prodromal symptom and half had more than one symptom that heralded the eclamptic seizure. Only 33% of women sought care for their symptoms, suggesting a need for proper patient education, which may have led to better outcomes.

Key Learning Points
1. Many women have a limited understanding of preeclampsia, its signs and symptoms and its danger to both the mother and baby.⁹
2. Lack of understanding of preeclampsia and its prodromal symptoms is even more profound among women with low literacy levels.⁴
3. Health care providers may often overlook patients’ complaints that in retrospect were predictors of increased risk or evidence of disease.
4. There is currently minimal education for a postpartum mother regarding preeclampsia at discharge from the hospital.
5. Symptoms of preeclampsia should be included in all prenatal and postpartum discharge instructions. This includes instructions for women who are released after in-hospital observation and before delivery.
6. Many hospitals now also include videos on matters relating to new mothers that they may watch prior to discharge. These videos provide both a verbal and visual way to reinforce the warning signs of preeclampsia and what and when women need to communicate with their doctors.10
7. New mothers may often disregard symptoms since they may not know what they “should” be feeling postpartum. Family members are key partners in preventing maternal deaths by intervening when their spouse or partner complains of shortness of breath, relentless headache and other concerning symptoms.

**Recommendations for Quality Improvement**

Providers should stress the importance of healthcare visits, during the pregnancy and after delivery, to assess the woman’s health status; she should also be encouraged to seek immediate medical assistance for shortness of breath and headache.1

1. A pictogram (below) showing the symptoms in visual format can be helpful to those women with language barriers or who may be struggling to understand the physician’s instructions regarding preeclampsia.11,4

2. Physicians and nurses should ask open-ended questions to ensure that the patient understands what they have been told (i.e., “teach back”). For example, after going over a list of symptoms say, “We’ve gone over a lot of information today. What would make you call or come in to the hospital?”12-14

3. Hospitals with video education abilities should include a video on preeclampsia for patient education.

4. Women who have experienced preeclampsia prior to delivery or while in the hospital should:
   a. Have a postpartum visit scheduled prior to discharge;
   b. See their obstetrical provider within one week if they are on anti-hypertensive medication(s) or two weeks if they are not on anti-hypertensive medications after discharge;
   c. Have their obstetrical provider consider providing instructions on monitoring their blood pressure at home with directions to call their obstetrical provider if their pressures reach or exceed 140/90.

5. A nurse should review (verbally and written) with the patient and her family prior to discharge all patient discharge instructions. The instructions must include recognition of and response to preeclampsia symptoms.

**References**

1. Hernandez, Leticia; Clark, Cheryl; Florida Department of Health, Florida Pregnancy-Associated Mortality Review Pregnancy Related Deaths, 2012 Data Update


PREECLAMPSIA FOUNDATION SIGNS AND SYMPTOMS INFORMATION SHEET

(Note: This is available from the Preeclampsia Foundation for a modest shipping and handling fee)

Additional resources: www.preeclampsia.org – includes patient education videos and brochures
APPENDICES
APPENDIX A: SAMPLE DISCHARGE SHEET FOR HYPERTENSIVE DISORDER PATIENTS

Instructions for Patients with Diagnosis of Preeclampsia, HELLP Syndrome or Eclampsia

It is very important for you to follow doctor instructions and pay careful attention to any symptoms you may have. For up to 6 weeks after delivery you are still at risk for emergencies related to your high blood pressure in the hospital. You have been given information about this condition—Yes____, No____.

Get emergency care if you have shortness of breath, headache, seizures, pain in the upper stomach area, or high blood pressure.

Do not wait to get care, it could be a matter of life or death. Take this information with you and tell the doctor you had a baby on ________________.

Take your Medicines as ordered (be sure to get them from the drug store as you leave the hospital):

1) _________________________ To be taken every ____ hours. Next dose due: ____________
2) _________________________ To be taken every ____ hours. Next dose due: ____________
3) _________________________ To be taken every ____ hours. Next dose due: ____________

Your follow-up appointment has been made with Dr. ____________________ in _____ days.

Date: ________________________Time: ______________________

It is important to keep this appointment.

You have been instructed to check your blood pressure at home daily: Yes____ No____

If your blood pressure is greater than ___140___systolic (top number) and/or greater than ___90___ diastolic (bottom number), call your healthcare provider ________________.

Phone Number: ___________________________ and if you cannot reach them, go to the emergency room.
APPENDIX B: SAMPLE DISCHARGE INSTRUCTIONS FOR ALL PATIENTS WHO HAVE BEEN PREGNANT

Discharge Instructions for All Patients who have been Pregnant

It is very important for you to follow doctor instructions and pay careful attention to any symptoms you may have. For up to 6 weeks after delivery you are at risk for emergencies related to your pregnancy.

Get emergency care if you have shortness of breath, headache, seizures, pain in the upper stomach area, or high blood pressure.

Do not wait to get care, it could be life threatening. Take this information with you and tell the doctor you had a baby on ____________.

Take your Medicines as ordered (be sure to get them from the drug store as you leave the hospital):

1) _________________________ To be taken every ____ hours. Next dose due: __________
2) _________________________ To be taken every ____ hours. Next dose due: __________
3) _________________________ To be taken every ____ hours. Next dose due: __________

Your follow-up appointment has been made with Dr. _________________ in _____ days.

Date: ________________________ Time: ________________________

It is important to keep this appointment.

You have been instructed to check your blood pressure at home daily: Yes____ No____

If your blood pressure is greater than __140______ systolic (top number) and/or greater than __90______ diastolic (bottom number), call your healthcare provider________________

Phone Number: ___________________________ and if you cannot reach them, go to the emergency room.
APPENDIX C: FPQC HYPERTENSION IN PREGNANCY TEAM DE-BRIEFING FORM
Adapted from the California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care and the FPQC OHI Toolkit

**Topic:** The de-brief form provides an opportunity for maternity service teams to review then document sequence of events, successes and barriers to a swift and coordinated response to a hypertensive crisis during pregnancy.

**Instructions:** Complete as soon as possible, but no later than 24 hours after any new onset hypertensive crisis or severe features preeclampsia episode. During de-brief, obtain input from participants (all or as many as possible). Attach additional pages with notes as needed.

**Goal:** De-brief completed in 100% of all hypertensive crises that are new onset or severe features of preeclampsia. All de-briefs have at least Primary RN, and Primary MD who participates in the de-briefing session. Separately, enlist feedback from the patient and/or her family regarding her time in the hospital as well as events leading up to her hospitalization that she believes may be relevant. HCAHP survey may be used, but should also include opportunity for free-form narrative. This input should be incorporated into the case review.

**Definition of New Onset Hypertensive Crisis:** Severe increase in BP that can lead to a stroke, typically systolic ≥ 180, diastolic ≥120

**Definition of Preeclampsia with Severe Features:** see back of this sheet

Thinking about how the hypertensive episode was managed…

**Were medications used? (if yes, check all that apply)**
- Magnesium Sulfate
- Labetalol
- Hydralazine
- Esmolol
- Propofol
- Calcium gluconate
- Nifedipine
- Steroids

**During the hypertensive episode, the patient required…**
- Intubation
- Central Line
- Arterial Line
- Admission to ICU
- Admission to higher acuity unit (e.g., PACU)

**Identify opportunities for improvement: “human factors” (Check if yes, describe)**
- Communication needed improvement
- Teamwork needed improvement
- Leadership needed improvement
- Decision-making needed improvement
- Assessing needed improvement
- Other

Briefly describe:

**Identify what went well (Check if yes, describe)**
- Communication went well
- Decision making went well
- Teamwork went well
- Leadership went well
- Assessing the situation went well
- Other

Briefly describe:

Check all that apply and note any that warrant comment:

**Patient Management**
- Fluid Management
- Airway Management
- Care during and post seizure, if indicated
- Outpatient management of chronic hypertension, if indicated
- Assessment for co-existing medical conditions
- Timing of delivery
- Postpartum assessment and care

**Procedures**
- Accurate Blood Pressure Measurement documented
- Early Recognition and Actions Taken
- Proteinuria Assessed and Actions Taken
- Nursing Assessment Protocol Followed and Actions Documented

**COMMENTS about medications, procedures, management:**

Who participated in the debrief? (check all that apply)
- Primary MD/DO/CNM
- Primary RN
- Other RNs
- Anesthesia
- Blood bank staff
- Pharmacy
- Lab team
- Rapid Response team

Other issues/concerns identified during debrief:
Definition of Preeclampsia with Severe Features

- Systolic blood pressure greater than 160 mm Hg or diastolic blood pressure greater than 110 mm Hg (*check blood pressure within 15 minutes to confirm since persistent elevation greater 160 mm Hg or 110 mm Hg is a hypertensive emergency*)
- CNS symptoms (generalized tonic clonic seizure, headache or visual disturbances)
- Pulmonary edema
- Platelet count less than 100,000/microliter
- Elevation serum transaminases more than 2 times over baseline or ALT greater than 70
- Serum creatinine level greater than 1.1 mg/dL or doubling of serum creatinine
- HELLP syndrome
APPENDIX D: ESCALATING CARE CONCERNS: CHAIN OF COMMAND

There are a number of communication tools that may be utilized to escalate care concerns in clinical situations that call for immediate attention, a change in care, or further evaluation. Below is a sample of these tools adapted from TeamSTEPPS. TeamSTEPPS has five key principles. It is based on team structure and four teachable-learnable skills: Communication, Leadership, Situation Monitoring, and Mutual Support. Located at the following site is a pocket guide resource tool for communication: [http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/essentials/pocketguide.html](http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/instructor/essentials/pocketguide.html) These tools help to assure that the team is on the same page when sharing information about a patient’s condition. Challenges and issues should be managed at the lowest level possible but some circumstances may require seeking assistance via the local chain of command.

**Effective Assertive Communication is:** Persistent, polite, timely, clear and solution focused

**SBAR-R-R (a method of sharing critical information that requires immediate attention and action concerning a patient's condition):**

- **Situation:** Always identify yourself, where you are calling from, the name of the woman you are calling about, quickly state the main reason and the level of urgency for the call, **Background:** Give brief pertinent background information – medical history, complaints, vital signs, and interventions that have already occurred, **Assessment:** Say what you think is going on, **Recommendation:** Say what you think should happen or ask for specific orders, **Reasoning:** If the response is not what you expect and requested, state why what you think should happen is important. What could happen if we don’t do this? **Ratification:** Close the loop by confirming actions to be taken. Assure mutual agreement on the plan.

**DESC (this is a way to resolve disputes or conflicts):** Describe the situation, Express how the situation makes you feel/your concerns, Suggest other alternatives/bedside evaluation and seek agreement, Consequences should be stated in terms of impact on established Team goals; strive for consensus.

**CUS (when the situation is deemed critical enough to stop and possibly take a different action):** Make the following statements: “I’m Concerned,” “I’m Uncomfortable,” “this is a Safety Issue” and state what you feel is needed.

**TWO CHALLENGE RULE** – When initial assertive statement is ignored, voice concern at least two times to ensure it has been heard; if the concern is not addressed or continues to be of concern, take the concern up the chain of command.

Use your local chain of command:

- **STAFF NURSE/CHARGE NURSE**
- **MANAGER/AOD**
- **DEPARTMENT CHAIR/VPMA**

COMMUNICATE WITH PROVIDER using these tools:

SBAR-R-R / DESC / CUS / TWO CHALLENGE RULE
APPENDIX E: HYPERTENSION BUNDLE RESOURCES

Hypertension Bundle Complete Resource Listing

1. READINESS


2. RECOGNITION


- Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA, Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care) Developed under contract #11-10006 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative, November 2013.

3. RESPONSE


All resources used with permission from the respective developing organization.
May 2015
Hypertension Bundle Complete Resource Listing

- Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA. *Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care)* Developed under contract #11-10006 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative, November 2013


4. REPORTING/SYSTEMS LEARNING

- Process Metric Examples


APPENDIX F: PATIENT SAFETY BUNDLES

In recent years several national partners including ACOG, AWHONN, SMFM, CDC, HRSA and others came together as the National Partnership for Maternal Safety and have worked with the Council on Patient Safety in Women’s Health to create several “bundles” of recommendations to improve the outcomes and safety of pregnant women.

The first bundle to be released focused on Obstetric Hemorrhage because hemorrhage is the leading cause of maternal mortality. It will be followed by other “bundles” for other high impact, high volume health and safety issues such as hypertension.

Bundles are a collection of succinct evidence-based components that when implemented together should have a positive impact on outcomes and safety for pregnant women. The bundles have four domains, Readiness, Recognition and Prevention, Response, and Reporting and Systems Learning. The bundles provide the core elements that every hospital can implement for every woman, every time. Birth facilities are encouraged to expand on the core component by developing policies, protocols and standardized practices that best meet local needs and are evidence based.

The Florida Perinatal Quality Collaborative includes a representative, Dr. Karen Harris, who participated in the development of the bundles as an ACOG representative and thus helped to guide the Collaborative in development of the Florida Obstetric Hemorrhage Toolkit. This toolkit follows the recommendations of the bundle and offers an expanded sample protocol and guidance for the four domains. It is expected that the local providers and birth facilities will adapt the toolkit within the evidence-based samples to have a localized set of practice expectations that will be followed by local providers.

The bundle Hypertension in Pregnancy developed by the national collaborative includes the following:

**Severe Hypertension/Preeclampsia Maternal Safety Bundle**

**Readiness:** (every unit)
- Adopt standard diagnostic criteria, monitoring and treatment for severe preeclampsia/eclampsia (include order sets and algorithms)
- Unit team education, reinforced by regular unit-based drills
- Process for timely triaging of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and readily available on L&D and in other areas where patients may be treated with brief guide for administration and dosage
- System plan for escalation, obtaining appropriate consultation and maternal transport, as needed

**Recognition:** (every patient)
- Adoption of a standard protocol for the measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Implementation of standard response to maternal early warning criteria
• Implementation of facility-wide standards for educating women on signs and symptoms of preeclampsia and hypertension prenatal and postpartum

**Response:** (all severe hypertension/preeclampsia)

• Facility-wide* standard protocols with checklists for management and treatment of:
  o Severe hypertension
  o Eclampsia, seizure prophylaxis, and magnesium overdose
  o Postpartum emergency department and outpatient presentation of severe hypertension/preeclampsia

• Support plan for patients, families and staff for ICU admissions and serious complications of severe hypertension.

**Minimum requirements for protocol:**

• Notification of physician or primary care provider if Systolic BP ≥ 160 or Diastolic BP ≥ 110 for two measurements within 15 minutes apart.

• After the second elevated reading treatment should be initiated ASAP (ideally within 60 minutes of verification)

• Protocol must include the timing for use of magnesium

• Describe postpartum follow up within 7 to 10 days of delivery

• Describe postpartum patient education

**Reporting/Systems Learning:**

• Implementations of a huddle for high risk cases and post-event team debrief

• Review all severe hypertension/eclampsia/ICU cases for systems issues

• Monitor outcomes and process metrics
  o Documentation of education of pregnant and postpartum women about symptoms of preeclampsia

*Note: “facility-wide” indicates all areas where pregnant or post-partum women are cared for, (e.g. L&D, postpartum, critical care and the emergency department, others depending on the facility)